ELECTRICAL REVIEW

THE OLDEST ELECTRICAL PAPER — ESTABLISHED 1872

Vol. CXXXVIII. No. 3560. FEBRUARY 15, 1946 9d. WEEKLY

Within the Law

Need for Revision of Outmoded Regulations

TWENTY years ago the goal of electricity supply was defined in the Weir Report as " the reduction in price and the greatest availability of electrical energy to the consumer." This maxim has furnished the motive of the several Acts passed since the end of the 1914-18 war. The guiding principle of earlier legislation is, however, by no means obvious. The framers of the fundamental Act of 1882 would almost seem, in retrospect, to have been more concerned to discourage too much zeal on the part of undertakings than to secure the greatest happiness of the greatest number of consumers.

Compulsory areas were made small in extent, while to afford supplies outside a local government boundary was made more difficult than to avoid responsibilities within it. Provisions enacted for regulating the relations and rights as between undertakings and consumers soon lost whatever value they once possessed. They call for early amendment, as Mr. W. Fennell easily established in his I.E.E. paper.

Made for DC Conditions

An outstanding fault of the 1882 Act was that it unwittingly took sides in what came to be known later as " the battle of the systems " and backed the loser. It thus stereotyped conditions that were more suitable for giving DC low-voltage supplies for lighting locally than for providing electricity for innumerable purposes throughout the whole country. Parliament could not be expected to foresee the effect of the Parsons-Ferranti-Merz combination in making practicable the supply of high-voltage AC from large well sited power stations (no longer " central stations ") over extensive areas, entailing overhead transmission and bringing in its train the electrification of dispersed industries and rural districts.

The result was not only to deprive the public of this country of many of the advantages of electricity made available by its engineers but also to handicap its manufacturers who have made up lee-way only by dint of great effort. Similarly the present advanced state of the undertakings has been attained only in spite of the strait jacket of statutory restrictions and is due to engineers who have interpreted the letter of the law in the light of what they regarded as its spirit.

" Safety-First " Abandoned

Undertakings as a whole have, in friendly emulation, gone far beyond their obligations to the public. Most of the provisions inserted in early Acts to safeguard their interests have been abandoned in practice on long-range commercial grounds, while current opinions of what constitutes " undue preference," however justifiable in aiding electrification, may not always satisfy legal pedantry. Such considerations may loom larger in the event of reorganisation and possibly greater centralisation of control of the supply industry, which may entail greater rigidity in adhering to the text of the law.

Consolidation and, presumably, amendment of existing statutes have for some time been under official consideration. The lesson of the past is that an Electricity Supply Act should be drafted on broad lines and should not incorporate details

that may prevent the immediate application of scientific and technical improvements. By the 1919 Act the Electricity Commissioners were empowered to promote the supply of electricity as well as to regulate and supervise it. They have made Regulations which can readily be amended as the need arises in the light of long and intimate experience of the industry and in close co-operation with its representatives. This procedure frees Parliament from the burden of discussing technical matters that form no part of the general permissive framework of the requisite legislation.

Back-room Work

AN inkling of the nature of the important contributions of the E.R.A. towards winning the war was given by Sir Charles Darwin at the Association's silver jubilee luncheon reported in this issue. These were quite on a par with its pre-war electrical achievements and like the latter were mainly due to anonymous teams, each member of which added his share to make a success of the whole. Since these achievements cannot be ascribed to a single name, as Sir Charles stated, they have received little attention in the lay Press; hence the public has little idea of their true value.

New E.R.A. Building

IN the plans for the new headquarters of the Electrical ResearchAssociation there is evident more than intention to provide adequate accommodation for laboratories and administration. Having regard to the small population of Great Britain, it is essential to retain and enhance this country's reputation for quality production. That applies especially to electrical work and a rightly telling point internationally is that British manufactures are based upon research which carries on a pioneering tradition. No doubt work quite as valuable in many fields can be done in unimposing structures but foreign observers are unlikely to be convinced of this at first glance, as they should be. Leatherhead should be a " show place " for the electrical industry.

The 240-V Standard

GOOD reasons for the adoption of 240 V as the standard for domestic consumers were given by Captain J. M. Donaldson in our issue of February 23rd, 1945, but all the same the Electricity Commissioners' decision to follow this course comes as something of a surprise. We must leave the detailed examination of the reasons behind this change of mind until next week, but it may be said now that the principal consideration is the saving of mains capacity, particularly in converting the present 250-V consumers.

Attack on C.E.B.

IN last week's *Spectator* there appeared an article by Wing Commander G. Cooper, Labour M.P. for Middlesbrough West, on " Nationalised Industry." The author, though presumably an advocate of nationalisation, has his doubts about it and admits that apart from the municipal public utility undertakings there have been few outstandingly successful examples of public ownership. He attributes this to a lack of drive, high executive ability, vision, enthusiasm and enterprise. To support his case he instances the Post Office, the London Passenger Transport Board and the Central Electricity Board. His choice of the Central Board as a horrible example is unfortunate on two counts. First it does not represent public ownership of an industry, and secondly Wing Commander Cooper seems to have taken as gospel some comments which appeared in an article published in a supplement to the *Architectural Review* last April and were dealt with in our issue of June 1st last.

Ill-informed Criticism

THIS is what Wing Commmander Cooper has to say about the Central Board:

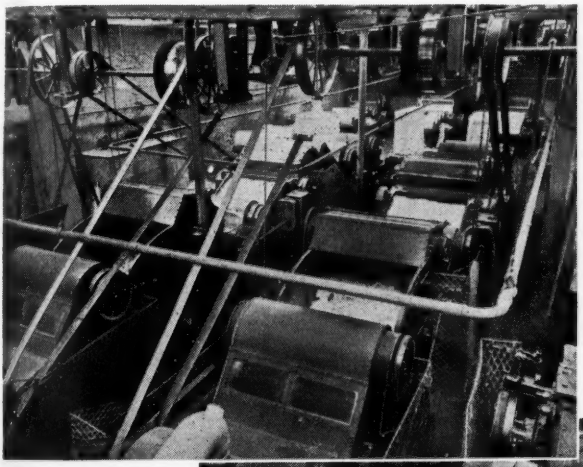
> " The Electricity Board has failed dismally in its task. It now requires vision and bold leadership from within itself in order to carry out its mandate—of making electricity universally available and cheapening the supply of electricity through the grid system. Its failure to work out any national plan to fulfil our social and economic requirements is paralleled only by its failure to extend electricity into rural areas."

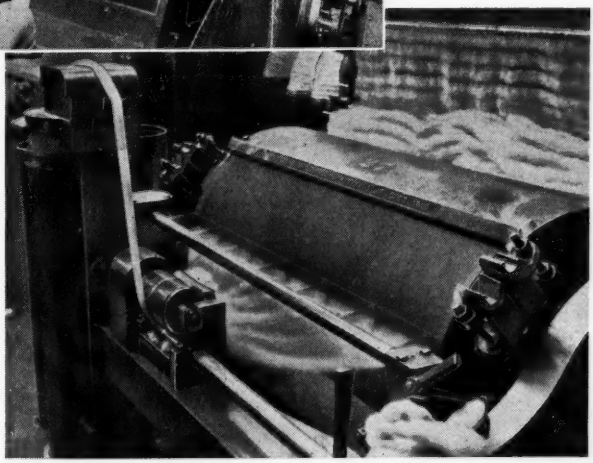
It is hardly necessary for us to tell our readers how fallacious and false these statements are; we quote them merely to show the kind of arguments put before a public anxious to know the facts of the nationalisation issue. They display a strange kind of logic, too. In order to justify nationalisation the imaginary shortcomings of a supposedly nationalised service are emphasised and we are left wondering whether he is for or against.

Making Cotton Cloth

Electricity in Modern Textile Mills

BY the courtesy of Fothergill & Harvey, Ltd., we recently visited the three mills of the Sladen Wood Mill Co., at Littleborough, which are engaged in the production of various grades of cotton cloth. The mills —Green Vale, Rock Nook and Sladen Wood —are on the banks of the Rochdale canal, with Sladen Wood at the north and Green Vale situated at about three-quarters of a mile south of this point. Generally the processes throughout all three mills are in the production sequence: under the arrangement adopted, the Green Vale Mill is devoted to the opening and spinning processes, the Rock Nook, to spinning, and weaving, and the centre mill, Rock winding, beaming Sladen Wood Mill entirely to weaving. With the exception of one section (spinning) of the Rock Nook Mill, which is soon to be converted and will be referred to in a later article dealing with the company's present change-over programme, all three mills are entirely electrified, and to simplify matters for our description we propose to outline the processes in the correct order of production without further references to the process details relating to the individual mills.

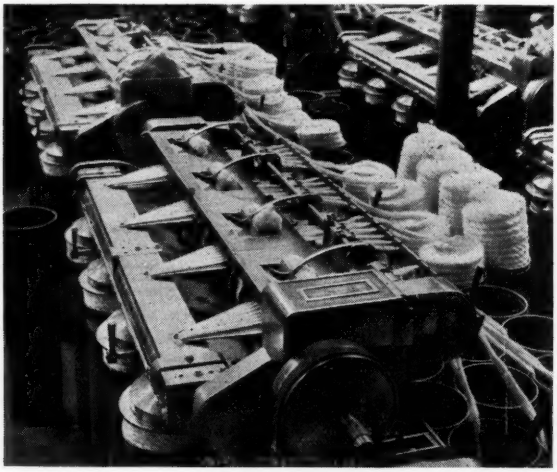




(Above) Group drive (100 HP) for opening room machinery
(Right) Each layer of fibre leaves the carding machine as a rope or "sliver"

The raw cotton arrives at the mills from the United States or Brazil, usually in 400-lb. or 500-lb. bales of various qualities. A most important requirement in cotton spinning is to ensure the maximum evenness of the yarn, and in order to attain this the greatest possible attention is paid to mixing thoroughly the various qualities of the raw

material in the initial opening-out processes. In the opening machinery the fibres are torn from the compressed state and converted into a state of fluffiness by a system of rollers, beater rollers and spiked lattices. During these processes the material is made to pass through perforated containers from which dust, seed cases, and other impurities, are drawn off by fans.



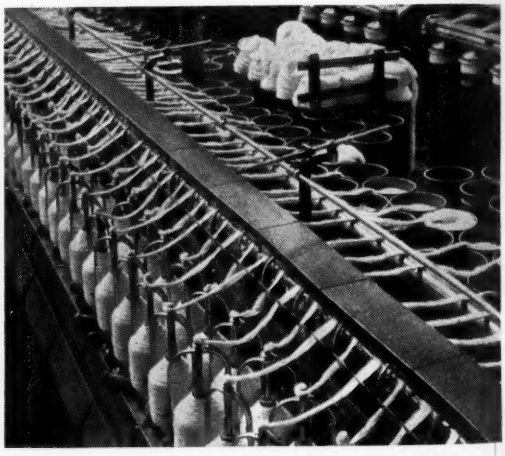
Six carding slivers are passed through a draw frame, attenuating the fibres into one draw-frame sliver

These processes as a whole involve a number of opening machines working progressively together as a system on the line-production principle, the cotton being passed through on lattice conveyers. The opened cotton is collected at the end of the system in the form of 50-lb. rolls or "laps." Four of these are passed simultaneously through a finishing machine in which they are reduced to a "finisher lap," thereby further ensuring the essential mixing of the material.

The opening or blowing-room machinery is the subject of a heavy group drive from a 100-HP, 416-r.p.m. motor which is directly coupled to a line shaft; from this there are even-ratio transmissions to counter-shafts from which there are speed-increasing transmissions to the machine shafts with actual overall ratios of from 485 r.p.m. to 1,220 r.p.m. The fans are incorporated in the machines and driven from the general system.

The "finisher laps" are transferred to the carding machines consisting of rolls of fine-wire bristles closely set against drums covered with fine-wire teeth. The cotton fibres are all combed out in one direction and form a loose layer about 3 ft. wide. As each layer leaves the machine it converges to a central point and finally emerges in a "bunched" condition as a rope or "sliver" which is coiled into cylindrical collecting cans ready for the next operation.

Six of the carding slivers are passed through a draw frame which attenuates the fibres into one draw-frame sliver. Further, six of the draw-frame slivers are then passed through another draw frame to form a final sliver which contains thirty-six of the initial carding

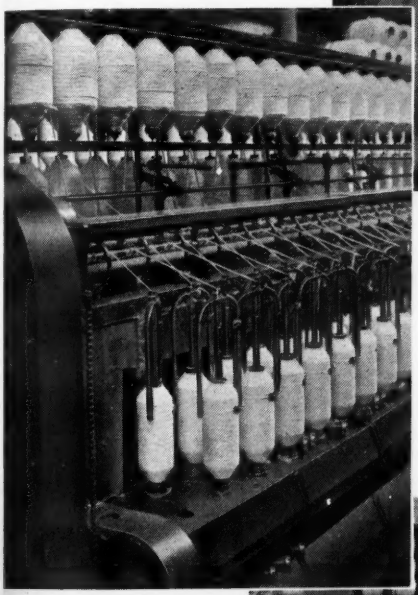


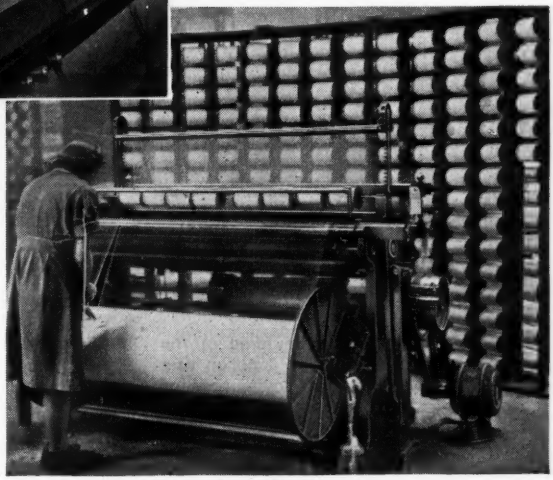
On the slubbing frame cotton is wound on to bobbins

slivers. If, during this process, one sliver breaks, a low-voltage tripping circuit instantly stops the draw frame, so that any number of slivers less than that required cannot be run through the machine. The tripping circuit incorporates pairs of rollers between which the slivers run and keep the circuit open by insulating each roll from its fellow.

It is actually in the draw frame that the attenuating principle common to all spinning processes is initiated. This is effected by two or more sets of rollers running progressively at increasing speeds, while the fibres are "clamped" by means of covered rollers. By this means the material is gradually drawn out into thinner strands. A particularly interesting group drive, embracing sixty carding machines and ten draw frames, has a 120-HP motor from which there is chain transmission to a line shaft with a speed reduction of 415 r.p.m. to 190 r.p.m. From the line shaft there are individual belt transmissions to the machines, with further reductions to about 160 r.p.m.

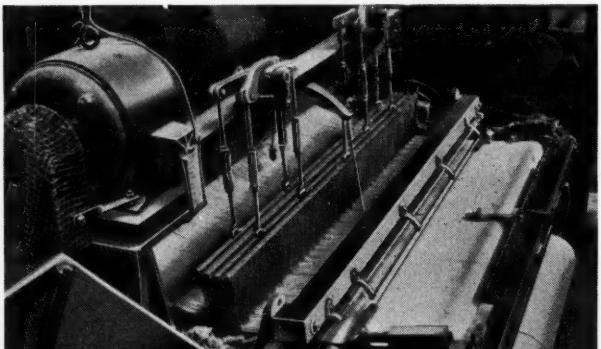
(Above) Yarn is spun entirely on ring frames in these mills

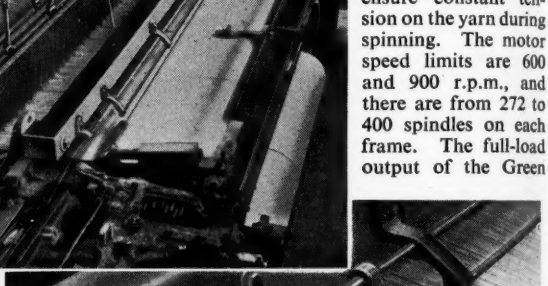




(Above) Wound bobbins from slubbing frames are similarly treated on intermediate and roving frames, but with increasing speeds and twists (Right) About 400 threads at a time are wound on a beam which can contain up to 21,000 yd. of thread

The final slivers are passed through a slubbing frame in which the cotton is wound on to bobbins for the first time, and in which the material is further drawn out on the same principle of progressively speeded rollers.





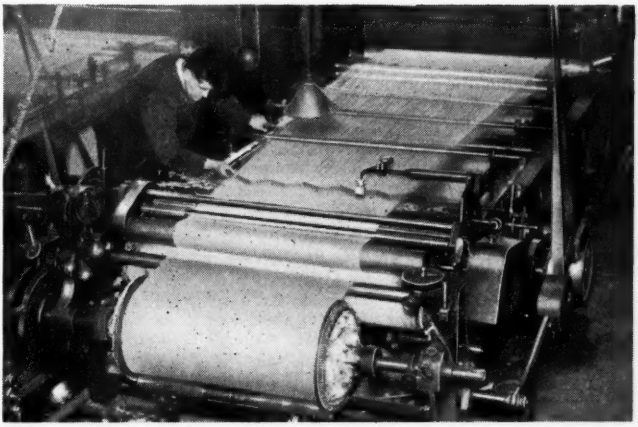
(Above) As the threads pass longitudinally through the loom some are raised and some lowered at each heald operation (Right) Shuttle carrying the weft passes from side to side of the loom and inside the shed at each operation

Further, as the cotton yarn is wound on to the bobbins it is given a slight twist. The wound bobbins are twice transferred to similar frames on which the process is repeated, but with increasing speeds and twists, forming, in turn, intermediate and roving bobbins. Three slubbing, eight intermediate and nineteen roving frames are driven from a 130-HP, 416-r.p.m. motor directly coupled to a line shaft from which there are belt transmissions to the machines at practically the same speed.

The next process is the spinning of the yarn which, in these mills, is done on ring frames. The cotton from the roving bobbins is again drawn through progressively speed-increasing rollers, and rewound on small paper tubes running at between 9,000 and 10,000 r.p.m. During this process each thread is passed through a small C-shaped traveller which is pulled round a ring on the frame, and this operation gives the cotton a very great twist which converts it into a hard thread. The spinning frames are individually driven by 6-HP variable-speed AC commutator motors. Each frame is fitted with a spinning regulator which varies the motor speed in conjunction with the rise and fall of the ring rail to ensure constant tension on the yarn during spinning. The motor speed limits are 600 and 900 r.p.m., and there are from 272 to 400 spindles on each frame. The full-load output of the Green Vale Mill, which embraces all the above-mentioned processes, but in which only warp thread is produced, is about 60,000 lb. of cotton per 48-hour week and the electrical consumption is about 25,000 kWh.

Weft thread is produced in an exactly similar manner in the Rock Nook Mill, except that the thread has a much softer twist, and is wound on special wooden bobbins inserted directly into the loom shuttles. The wound paper-tube bobbins from

Green Vale are introduced to the winding room, where the thread is rewound on to wooden bobbins ready for the beaming frames. The winding frames are individually driven by 4-HP motors with V-rope transmission reducing the speed from 960 to 136 r.p.m. The wound bobbins are placed in creels, and about 400 threads at a time are wound on to a beam which can contain up to 21,000 yd. of thread. The beaming frames are also individually driven by ½-HP loom-type motors, in each case with belt transmission to the machine with a speed-reduction of about 3 to 1.



Threads from up to six or seven beams are passed through a size solution and drying chamber

As the thread has to withstand severe chafing during weaving, it has to be protected, and for this purpose the threads from up to six or seven beams are passed together through a size solution and a heated chamber in which they are dried to a required humidity. The thread is then rewound on smaller beams, each containing about 900 yd. and up to 2,500 ends. Six sizing machines are group driven by a 25-HP motor through a V-belt transmission which results in a final speed of 176 r.p.m. from an initial speed of 585 r.p.m. The size solution is mixed in steam-heated vats in which it is continually stirred from a motor-driven line shaft running at 45 r.p.m. This low speed is obtained by a double reduction V-belt from a 20-HP, 720-r.p.m. motor.

The warps, which consist of the sized twist yarn, are then prepared for weaving, which entails threading the yarn ends in the healds and reeds which are responsible for producing the correct patterns during weaving. Each yarn end on the beam has to be threaded through an appropriate space in the reed and through a definite eye in the heald. Up to five healds may be used on a loom, according to the pattern required. One thread out of place will spoil the whole cloth piece. This intricate operation is effected on motor-driven drawing-in machines, each of which will set to pattern in twenty minutes the work equivalent of five or six hours by a skilled hand.

For the repetition of a pattern it is possible on a warp-tying machine to take a short piece of the previous warp and to tie a new warp to it, thus saving re-threading. The knots are tied at about 200 per minute on machines which are individually driven by fractional-HP motors. The threaded-up warps are then introduced to the looms.

As the threads from the beam pass longitudinally through the loom they are raised or lowered at each shedding operation, according to their relative positions in the healds, when a V-shaped passage or shed is thus formed by the displaced threads. A shuttle carrying the weft passes from side to side of the loom and inside the shed at each shedding operation. After each interlacing of the beam (warp) and shuttle (weft) threads the reed moves forward to beat up the new shuttle thread against the preceding shuttle thread at the fell of the cloth.

The looms at Rock Nook are of the automatic Northrop type and are generally individually driven by ½-HP spring-mounted motors fixed to the floor in most cases, although some surmount the loom frames. The loom motors have a special drum-type switch controller operated automatically from the loom starting handle. At the Sladen Wood Mill there are about 500 Lancashire looms group driven by a 270-HP

motor with chain transmission to a line shaft from which there are belts to the individual looms.

After weaving, the cloth is passed through cropping machines which, by means of very accurately adjusted revolving knives, trim the surfaces of the cloth. The cloth is then passed to the cloth looker for inspection and finally plaited (folded) in yard lengths, after which it is sent to the warehouse for transport. Three cropping and three plaiting machines are group driven by a 28-HP, 415-r.p.m. motor, with V-belt transmission giving a line shaft speed of 210 r.p.m.

The output at the Rock Nook Mill (weaving only), is about 230,000 yd. of cloth per week for a consumption of about 16,000 kWh. The output of the Sladen Wood Mill is about 70,000 yd. of cloth per week with a consumption of about 8,000 kWh. All the larger motors throughout the mills are slip-ring machines controlled by oil circuit-breaker stator switches and oil rotor-resistance starters. All the smaller motors are squirrel-cage units served either by push-button contactor-type or drum-type starters interlocked mechanically with the starting mechanism of the machines.

Transportable H.V. Switchgear

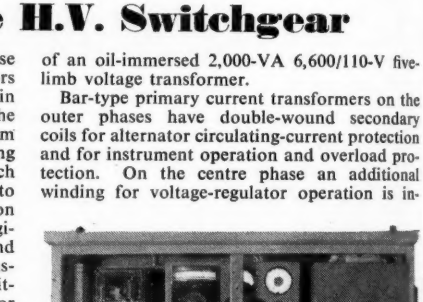
HIGH-VOLTAGE switchgear for indoor use with mobile 2,500-kW turbo-alternators ordered by the Ministry of Supply for service in war-devastated areas has been made by the British Thomson-Houston Co., Ltd., in the form of weatherproof sheet-steel cubicles measuring 7 ft. by 5 ft. 4¾ in. by 7 ft. 3½ in. high. Each unit is divided into four main compartments, to which access is obtained by removing bolted-on covers. One of these compartments is longitudinal for accommodating the busbars and three are lateral for housing the voltage transformer, the current transformers and oil circuit-breaker and the isolating switches and fuses for the auxiliary transformers.

The synchronising and tripping circuits run right through the cubicle and are terminated in sockets at the ends, facilitating the coupling of two or more units. The equipments and insulation conform to B.S.S. 168 for 6·6-kV systems with insulated neutral. They have been designed for service in a maximum ambient temperature of 95 deg. F. and at a maximum altitude of 3,300 ft. The short-circuit capacity is 50 MVA, but the breaker is tested to 150 MVA to allow of connection to other sources of supply.

The oil circuit-breaker controlling the alternator is mounted centrally in the cubicle on a wheeled carriage and isolated by vertical plugging. It can be run out for inspection and maintenance. The alternator output is metered on a panel above the circuit-breaker and the automatic voltage regulator is mounted on shock absorbers. The field-control rheostat and switch are behind the panel to the right of the circuit-breaker.

Overload protection is by means of a Type PBO relay with trip coils shunted by time-limit fuses as standby. Differential protection is provided for the alternator (the auxiliary transformer is not included in the differential zone). Earth-fault protection includes an alarm relay energised from the broken-delta tertiary winding of an oil-immersed 2,000-VA 6,600/110-V five-limb voltage transformer.

Bar-type primary current transformers on the outer phases have double-wound secondary coils for alternator circulating-current protection and for instrument operation and overload protection. On the centre phase an additional winding for voltage-regulator operation is included. The high-voltage fuses and current-limiting resistances are accommodated in the bushings of the voltage transformer. The lower-voltage fuses are mounted on top of the transformer.



Transportable high-voltage switchgear unit with front covers removed, showing stowage of items of equipment

A 25-cell Nife battery and a metal rectifier with high- and low-rate charging switches are housed in a separate sheet-steel casing. A 500-kVA 6,600/440-V auxiliary transformer, controlled by a three-pole isolating switch and h.r.c. fuses is connected to the machine side of the oil circuit-breaker.

Electrical Research

Sir Charles Darwin's Address

THE address to the British Electrical & Allied Industries Research Association was delivered by Sir Charles Darwin at the annual luncheon held on February 8th at which nearly 450 members and guests were present. It was in the form of a response to the toast of "The E.R.A." which had been proposed by Mr. V. Z. de Ferranti, vice-president of the Institution of Electrical Engineers, who stated that he was deputising for the president, Dr. P. Dunsheath, now in Canada. Drawing attention to the occasion as the silver jubilee of the Association, Mr. de Ferranti indicated the growth of its work by reference to the original staff of three receiving a grant from the Department of Scientific & Industrial Research of £8,000 and the present staff of 200 with a grant of £70,000 last year. There would, he believed, be no difficulty about money if good research workers were available. After appreciative mention of the invaluable work of Mr. E. B. Wedmore (the former director), who with the secretary Mr. E. B. McMahon and the staff had carried out work of great national importance during the war (when the buildings were damaged by bombs on eighteen occasions), he referred to the 48-acre site at Leatherhead which had been secured for the future home of the Association.

The Industry's Contribution

Sir Charles Darwin spoke of the relationships between the E.R.A. and the D.S.I.R. and the National Physical Laboratory. The E.R.A., he said, differed from the other thirty or so similar organisations, in that research was not centred almost entirely in it, the expenditure by the whole electrical industry being very much greater than that allocated to the Association; this he regarded as a good thing for the country in maintaining its electrical position. One of the most useful fields of work of the E.R.A. was in reducing radio interference especially in tank communications in the desert. Other war activities included insulation and protection of electric circuits in vehicles, *e.g.*, amphibious tanks, fitting equipment to withstand tropical conditions (which proved of primary importance in the Burma campaign) and the magnetometer for detecting buried mines. Sir Charles congratulated the Association on having secured the services of Dr. Whitehead as director and expressed his pleasure that Mr. Wedmore to whom its present flourishing state was so largely due would be still available as adviser.

Commenting on the programme of research, he was surprised to find that, in addition to purely electrical matters, such as dielectrics (one of the most exciting subjects of study just now), surge phenomena and circuit-breakers (especially the air-blast type in which the E.R.A. had led the world), the work included investigations into such apparently extraneous fields as special steels for boilers—an indication of more statesmanlike qualities in the electrical industry than in others.

There had been only three really revolutionary discoveries in human history—agriculture, cities (about 4000 B.C.) and the radical improvement that could be made in ways of life through the scientific study of nature, which was begun only about 150 years ago. The process showed no signs of slackening (though he believed atomic energy would not be put to useful purposes for many years) and the only reasonable certainty about the world was that it would continue to change. Not to research was to bet on the contrary view and was therefore the most speculative thing one could do. The health of the president was proposed by Mr. Robert Lee, who succeeds Captain J. M. Donaldson as chairman of the Council.

Daylight and System Loads

A TECHNICAL Report of the British Electrical and Allied Industries Research Association (Ref. K/T115, 13s. 6d. net) has been issued on the "Relation Between Daylight Illumination and System Load," by P. Schiller. The present Report forms a sequel to an earlier one which presented "An Analysis of the Load on a Modern Electricity Supply Undertaking" (Ref. K/T108) and is worked out on the justifiable assumption that, of the various factors affecting in combination the seasonal variation of the system load, daylight illumination offers the most promising basis for establishing a functional relationship between cause and effect. Once a satisfactory law is established, the corresponding component of the total system load can be isolated, thus facilitating the analysis of the remaining seasonal load.

For measuring daylight illumination on a standard basis, apparatus has been developed linking measurement to the north quadrant of the sky. Analysis is based on the comparison, over a series of comparable days, of the system demand at a given half-hour. The effects of daylight illumination and temperature are isolated by means of regression analysis. For the partial relationship between illumination and incremental seasonal demand, a semi-logarithmic curve has been found to give the closest fit. Additional factors that can also be considered are illustrated with reference to the force of wind. An appendix by N. L. Johnson outlines the mathematics of multiple or combined regression analysis.

Views on the News

Reflections on Current Topics

RECENTLY in the *Evening News* (Glasgow) a contributor, referring to the use of three-core flex with two-pin plugs, quoted "a Corporation electricity official" as saying that "the earth wire was fitted for extra-safety purposes—sponsored by Government authority. With an appliance such as an electric radiator earthing is not so very important, but with an electric iron used in a stone-floored kitchen, for instance, it's to be recommended. For an electric washing machine it's absolutely essential." In a later issue a "Chartered Electrical Engineer" rightly pointed out that the earth wire was provided for ordinary, not extraordinary, safety. He also rightly condemned the suggestion by the author of the article that when attaching three-core flex to a two-pin plug the earth wire should be cut back and bound into the flex with insulating tape.

* * *

Apropos my remarks last month about the possibilities of the use of fluorescent tubes for indirect lighting Mr. J. Mortimer Hawkins, managing director of the Mortimer Gall Electrical Centre, has drawn my attention to an installation which his company has carried out at the Abdulla showrooms in Bond Street, London. Here a combination of daylight and "warm white" tubes has been concealed above the tops of the showcases around the room. The resulting soft, shadowless illumination is certainly most satisfactory and effective. Messrs. Abdulla are extremely pleased with the installation, their only complaint being that the lighting is so good that it means that they have got to buy a new carpet!

* * *

At the Wood End Park Estate, Hayes, Middlesex, a singularly involved situation has arisen with regard to the electricity supply, so involved in fact that I am a little hesitant to refer to it. Apparently the estate was started as a private concern and is served by a special electricity and water supply plant. This plant has for some time past proved inadequate to serve the 800 houses on the estate, electricity having frequently to be cut off due to the demand being about twice the capacity available. As a protest the tenants decided to pay only 12s. 6d. of the 16s. 6d. rent. This was followed by the supply being cut off altogether, and the latest development is that the owner of the houses has taken out summonses against twenty-seven of the tenants for the possession of their houses, the owners of the electricity undertaking being summoned as third parties. In view of these difficulties the obvious solution to the problem would seem to be for a public electricity supply to be provided to the estate by the authorised undertakers for the area, the Metropolitan Electric Supply Company. On investigation it seems that the company has in fact received applications for supplies from tenants and is willing and indeed anxious to help in the matter. There is, however, some legal question about the ownership of the houses and until this is settled negotiations are more or less at a standstill.

* * *

The question of contributions from electricity profits to the rates still keeps on cropping up. This time it is Croydon. At a recent meeting the Electricity Committee proposed that £9,106 of the profit for 1944–45 (£56,000) should be transferred to the rate fund but the Council decided that it should be kept in the Department's reserve fund. In its forty-seven years the Department has contributed a total of £346,500 to the rates, of which £225,000 has been taken in the last ten years. During the debate it was mentioned that the cost of the Department's new showrooms (£130,000) had been defrayed from the reserve fund and that £20,000 of the amount which it was now proposed to place to reserve was to be earmarked for the purchase of domestic appliances. On the whole the non-electrical ratepayers of the county borough seem to have done pretty well already and should approve the businesslike policy of the Electricity Committee.

* * *

Until I visited the Amusement Devices and Trades Exhibition at the Royal Horticultural Hall last week I was not aware of the extent of the use of electricity in the present-day amusement park and fun fair. From roundabouts and "dodgems" to shooting galleries, pin-tables, "jupe boxes," skee-ball and the "What the Butler Saw" type of cabinets there is scarcely a single item which does not employ electricity for some purpose or other. Some of the methods adopted by the designers of the devices to overcome special electrical problems are particularly interesting, as for example the way injury to the motors of the very-much maltreated "dodgem" cars is prevented. As before the war at least 95 per cent. of the machinery used in the amusement industry was imported it seems to me that there is plenty of opportunity for British electrical manufacturers to find a new outlet for their products—if they want one.—

REFLECTOR.

Electrical Legislation

Suggested Amendments and Modifications

AFTER MR. W. FENNELL had read his paper on "Fundamental Legislation for Electricity Supply to Consumers" (see *Electrical Review*, February 8th, p. 205) at the Institution of Electrical Engineers on February 6th (MR. V. Z. DE FERRANTI presiding), the discussion was opened by SIR JOHN KENNEDY (deputy chairman, Electricity Commission) who said he was almost entirely in agreement with the suggestions made in the paper. The Electricity Commission had had many of these matters in mind before the war, but now he did not think much could be done until it was known what form the industry was going to take. It might be that guarantees by consumers would become unnecessary if the distribution of electricity were placed in the hands of Regional Boards. As a quite personal view, he thought guarantees should be abolished and consumers, except perhaps in the absolute "wilds," should have a free service. It was no good canvassers asking people if they would like to have electricity. Consideration must be given to the types of people and whether they could afford to take a supply at the tariff offered. After some comments on the need for considering means for preventing the destruction of local amenities when providing supplies to rural areas, Sir John said he hoped it would be possible to give effect at no very distant date to many of the valuable suggestions made in the paper and he looked forward to the consolidation and amendment of archaic legislation.

Rapid Action Necessary

SIR JOHN DALTON (County of London E. S. Co.) said the industry had been waiting twenty years for amendment and consolidation and now Sir John Kennedy hinted that this might be postponed again. The industry might pass into the hands of people who were more rigid in their views as to the application of the law than was at present the case and put back the progress of the industry for some twenty years. Therefore, he thought action should be taken quickly.

The suggestions in the paper with regard to compulsory areas were academic as there were very few places in urban and rural areas which did not have supplies and he thought the present regulations of the Commissioners were sufficient. The whole section of the paper dealing with requisition could be scrapped as it had been out-moded by the development that was taking place. The practice of his company before the war was to provide a considerable run of service free to the consumer but, as the cost of services was now between 60 and 100 per cent. greater than before the war, there was a limit to what could be done. Although the cost of coal in the South of England had increased by 140 per cent. and in other parts by 125 per cent. supply undertakings, by and large, were supplying at the same prices as pre-war and virtually were not allowed to increase them. Therefore, it was very difficult to give further concessions to consumers. The control of dividends and prices in the case of the London companies had stimulated the reduction of charges. His company provided meters free of charge to two-part tariff consumers.

Minimum Obligations Exceeded

MR. FORBES JACKSON (L.C.C.) said it must not be assumed that the clauses discussed in the paper were the only ones which affected the consumer. At present the consumer was not really restricted; it was rather the fact that undertakings had exceeded their minimum obligations that had caused the present confusion because there was no uniformity. Some concerted plan among undertakings was necessary. He had misgivings about too much detailed legislation. If a voluntary system did not work then many of the points now dealt with in Acts should be removed and included in the Commissioners' Regulations so that they could be amended from time to time without further legislation.

MR. R. A. S. THWAITES (Manchester Electricity Department) commented on the definition of a consumer and on interruption of supply due to "unavoidable" accidents. As regarded a requisition by six consumers, not only had he not seen one but he had never even seen a form for that purpose although all supply undertakings were supposed to keep a supply of them. At present a consumer could sue a supply authority; what would be the position under any form of nationalisation?

MR. J. ECCLES (Liverpool Electricity Supply Department) said the industry had outgrown legislation, but it was essential that it should

not now be made so tight as to restrict progress. Had the Commissioners more thrustfully carried out one of their functions, which was to " promote " electricity supply, the industry might have been even better than it was to-day. An estimate of the consumer's demand was useful especially for deciding the type of meter, etc., to be installed and he also felt that the minimum charge should be on an annual basis. Disputes about meters should go to arbitration, if necessary, and should not entail litigation. In the present period of " steeplechase " legislation it was too late now to do anything by way of consolidation.

Control of Apparatus

MR. W. N. C. CLINCH (Northmet Co.) said that having regard to the manner in which electricity supply had progressed irrespective of legislation he wondered why Mr. Fennell had made all these suggestions. Why did not Mr. Fennell turn his attention the other way and say that to use electricity it was necessary to use apparatus, and suggest fundamental legislation with regard to the manufacture of apparatus for the proper use of electricity.

MR. G. H. FOWLER (City of London Co.) said that 11 kV and 6 kV must be regarded as ordinary distribution voltages in densely loaded areas. This meant that transformer space must be provided on consumers' premises. He suggested compulsory powers for acquiring space for transformer chambers in densely loaded areas on the lines on which wayleaves were obtained.

MR. P. MAIR, who referred to his recent connection with the Ministry of Fuel and Power, said that in the future electricity might be in the hands of impersonal corporations whose relations with consumers, generally speaking, must be more remote and less personal than had been the case in the past. Therefore, it seemed to him that future legislation should provide for the maximum possible rights for the consumer and the minimum of protection for the undertakings.

MR. C. O. MCLEAN (Edmundsons) thought there were several points on which Mr. Fennell was wrong. The industry should not support the idea of allowing a consumer to put in his own service lines and be responsible for the voltage drop. Supply engineers would still get the blame and the consumer would have to make his own arrangements. Also, as regards the no-preference clauses, the author had omitted several features which the Commissioners had to take into account, such as the period of agreement and the capital which might be rendered useless when the consumer ceased to take a supply. In many rural cases there was justification for asking for a 50 per cent. guarantee.

MR. T. H. CARR (Bradford Electricity Department) said his undertaking asked for a 20 per cent. guarantee on a five-year basis and that worked very well. In Bradford meter rents brought in £19,000 a year, which he would find difficult to cut out. At the same time, meter rents could be abolished and included in the fixed charge.

MR. R. BALDWIN commenting on the question in the paper regarding the ownership of a service line, said that the Courts had ruled that notwithstanding that the consumer had paid towards the cost of the cable, it belonged to the undertaking but the consumer had the exclusive right to its use. Under nationalisation there should be an agreement between the consumer and the supply authority or State—to safeguard the consumer's rights and enable him to sue the Minister of Fuel and Power, if necessary, for the torts of his officers.

MR. J. LESSER (City of London Co.) thought that service lines must be regarded as part of the distribution system. Instead of requiring the owner or occupier to pay the cost of the service in excess of 60 ft., he should pay an annual rental for a specified period which would settle the question of responsibility for ownership and maintenance.

MR. FENNELL in a brief reply to the discussion, dealt only with the " no-preference " clause. He said he was not suggesting that it should be retained in its present form, or amended or abandoned. All he had said was that if there were a no-preference clause it was obvious that the legislature intended that preference should be shown. If the clause intended that no preference should be shown, then it should be amended.

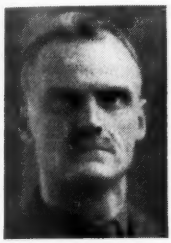
Industrial Research

AT the February meeting of the Coventry Electric Club Mr. F. W. Godden, city electrical engineer, was in the chair and Mr. H. Warren, M.Sc., M.I.E.E., delivered a lecture on " Electrical Research." The lecture was divided into three sections: The contribution of an industrial electrical engineering research laboratory to the engineering organisation with which it was associated; the contribution of such a research laboratory to general knowledge; and research personnel. The meeting ended with the showing of a film giving glimpses of classical researches, culminating in Faraday's work.

PERSONAL and SOCIAL

News of Men and Women of the Industry

AFTER holding the position of deputy electrical engineer of Tunbridge Wells for the past year **Mr. T. W. Dann**, A.M.I.E.E., has been promoted to borough electrical engineer to succeed **Mr. R. N. Torpy**, who retires on April 30th. Mr. Dann, who is forty-four, was educated at the Liverpool Collegiate School and Liverpool University where he obtained the B.Eng. (Hons.) and M.Eng. degrees. He was granted the David Rew Scholarship for post-graduate research under Professor E. W. Marchant. From 1919-25 he served with Campbell & Isherwood, Ltd., Bootle; Cammell Laird & Co., Ltd., Birkenhead; the White Star Alkali Co., Ltd., Bootle; and the English Electric Co., Ltd., Preston. Then after four years as chief assistant to the head of the Switchgear Development Department of the General Electric Co., Ltd., Witton, he was in 1929 appointed personal technical assistant to the managing director of the Northampton Electric Light & Power Co., Ltd. In 1941 he became chief engineering assistant to the Poplar Borough Council Electricity Department.



Mr. T. W. Dann

Mr. Colin F. Campbell, chairman of the Telegraph Construction & Maintenance Co., Ltd., who was raised to the peerage in the New Year Honours, has taken the title of **Baron Colgrain**, of Everlands, in the County of Kent.

Sir Leonard Pearce, C.B.E., following on his appointment as a director of Central London Electricity, Ltd., and London Associated Electricity Undertakings, Ltd., has been appointed by those companies as a director of London Power Co., Ltd.

Mr. E. D. A. Herbert, O.B.E., M.A., A.M.I.C.E., M.I.Mech.E., M.I.E.E., has been appointed a director of the London Electric Supply Corporation, Ltd.

The directors of Drake & Gorham, Ltd., have presented **Mr. A. Channon** with a silver salver to mark his completion of fifty years' service. Mr. Channon is at present the head of the counting house at the company's Manchester branch.

On February 2nd, the large canteen at Magnet House was once again reserved for the younger generation of the G.E.C. Head Office staff. They were the guests of the **Hon. Mrs. Gamage** (wife of Mr. Leslie Gamage, vice-chairman of the G.E.C.). This was the first post-war function of its kind. After a hearty meal and a few words of appreciation by Mrs. Gamage of the splendid contribution by Mr. Albert Griggs, chief house engineer of Magnet House, the party were taken to the Phœnix Theatre to see the show "Under the Counter."

Mr. F. H. Kingsnorth has been appointed chief sales accountant at the head office of the General Electric Co., Ltd., in succession to **Mr. S. F. Thomas**, who retired at the end of last year. Mr. Kingsnorth joined the company as a commercial apprentice in 1919. After some years of experience in the Accounts Department, Head Office, he was transferred to Manchester where he became district accountant for the North-Western Area in 1935. He returned to London in 1941 to control the accountancy in connection with Government contracts.

Major E. A. Barker, M.C., M.I.E.E., borough electrical engineer and inspector of public lighting at Barnsley, is retiring at the end of next month. He has been with the Corporation for forty-six years, having commenced as chief assistant in 1900, and being appointed to his present position in 1903. After education at the Technical College, Birmingham, and a period with the Walsall Electrical Co., Ltd., he joined the Walsall undertaking in 1898 as outdoor assistant, going to Hull the following year as junior assistant.

Mr. W. P. Trenhaile, A.M.I.E.E., has been appointed research and development engineer to Moffats, Ltd. For the past four years Mr. Trenhaile has been with the Ministry of Aircraft Production at the Telecommunication Research Establishment at Malvern; he was previously electrical engineer to the Shell-Mex and B.P. Co.

Mr. W. P. Trenhaile

Mr. W. H. Williams, mains assistant in the Liverpool Electric Supply Department, has been promoted to senior mains assistant and **Mr. H. Telfer**, A.M.I.E.E., district junior mains assistant, becomes district h.v. engineer. **Mr. C. C. Smith**, A.M.I.E.E., canvassing assistant, is now designated engineering assistant—distribution, at increased salary.

At the annual dinner and dance of the Electrodepositors' Technical Society held in London on February 1st, **Dr. S. Wernick**, past hon. secretary, was presented with a silver inkstand and **Mr. F. L. James**, hon. treasurer, with a silver tea service. Dr. Wernick, who is president for

the current session, in his response said that the Society would shortly celebrate its coming of age and he thought that probably the most appropriate way of marking the occasion would be to organise the third international electro-depositors' conference.

Lt.-Comdr. (E.) C. H. Hayward, M.I.Mech.E., is leaving Great Britain immediately for the West Indies and Central America as resident superintendent for the marketing and servicing organisations of British Oil Engines (Export), Ltd., the Brush Electrical Engineering Co., Ltd., and subsidiaries.

An inspection of the B.B.C. television transmitting station at Alexandra Palace took place

Messrs. M. Gorham and D. C. Birkinshaw

last week. We reproduce a photograph taken on the occasion of **Mr. Maurice Gorham,** director of television, and **Mr. D. C. Birkinshaw,** superintendent engineer.

Mr. S. G. Burdick, M.B.E., who was recently released from the R.A.F. after five years' service at home and abroad on administrative duties, has left the British Power & Light Corporation, Ltd., with whom he served for many years on sales promotion, publicity and purchasing, after experience with other electricity supply authorities. His address is Bickerley Cottage, Ringwood, Hants.

Mr. A. E. Mellerup, a director of R. A. Lister & Co., Ltd., is retiring. He joined the company fifty-one years ago and was elected to the board in 1921.

Mr. George Whitelock, B.Sc., A.M.I.E.E., A.M.I.Mech.E., has been appointed assistant manager of the engineering and electrical departments of the Scottish C.W.S., Ltd. Before the war he was chief electrician to the departments, being seconded to Woolwich Arsenal.

The occasion of the fourth anniversary of the formation of the South-East Branch of the Association of Supervising Electrical Engineers was marked recently by a social evening held at the Embassy Ball Rooms, Welling. The varied programme included games, dancing, a film show (including a film of the Barking power station) and a conjuring display. Mr. A. D. Culling, the branch vice-chairman cut and distributed the party cake and welcomed Mr. J. Flood, the past chairman of the Association, who represented the executive council.

Mr. J. V. Levett, chief electrical engineer, Thos. Broadbent & Sons Ltd., Huddersfield, has recently retired. His address is "Thorpe Meade," Thorpe Lane, Almondbury, Huddersfield.

The first annual social of the Northampton and District Electrical Association was held on January 26th, when more than 90 members and friends attended. A successful concert was arranged and the second half of the evening was devoted to dancing. Mr. O. F. Bailey was compere.

Mr. J. McGowan has joined the Sterling Varnish Co., Ltd., as assistant to Mr. F. Meyer, technical director. Mr. McGowan was for nine years in the Research and Development Department of the Metropolitan-Vickers Electrical Co.

Mr. G. Laycock, of York, and **Mr. J. I. Wood,** of Stafford, have been appointed charge engineers with the Blackpool Corporation Electricity Department.

Mr. W. Griffiths, power stations engineer, Sheffield Corporation, is to retire under the age limit after fifteen years' service with the Corporation.

Obituary

Mr. F. Parkinson.—A memorial service for Mr. Frank Parkinson, LL.D., M.I.E.E., was held on February 7th, at St. Margaret's, Westminster; the Rector, the Rev. Canon A. C. Don, D.D., officiated. Among the large congregation present were:—Mrs. Doris Parkinson (widow), Mr. Arthur Parkinson (son), Mr. Albert Parkinson, M.B.E. (brother), Mr. and Mrs. Dennis Burke (stepson and wife) and Lady Forrest (mother-in-law). The directorates of Crompton Parkinson Ltd., and the British Electric Transformer Co., Ltd., were represented by Mr. J. Harwood Fryer, Mr. E. C. Holroyde (with Mrs. Holroyde), Mr. T. H. Windibank and Mr. C. F. Dickson. Members of the London office staff and representatives of the works at Guiseley, Chelmsford, Derby, Hayes, New Malden, Birmingham, Leicester and of home and overseas branches, also attended and Mr. H. H. Spencer represented the Association of Old Cromptonians. Leading members of the electrical industry included Sir George H. Nelson (English Electric Co.), Sir Harry Railing (G.E.C.), Sir George E. Bailey, C.B.E. (Metropolitan-Vickers), the Hon. Mrs. Leslie Gamage and Mr. Leslie Gamage (G.E.C.), Sir Montague Hughman (Henley's), Sir Edward Wilshaw (Cable & Wireless, Ltd.), Mr. V. Z. de Ferranti (Ferranti, Ltd.) and Mr. V. Watlington.

Mr. H. J. Mayes.—We regret to report the sudden death of Mr. H. J. Mayes, who had represented Foster Electrical Supplies, Ltd. in London for twenty-six years. In his younger days he was well known in first-class Essex club cricket.

Mrs. P. P. Wheelwright.—We regret to record the death on February 5th of Mrs. Jessie Wheelwright, wife of Mr. P. P. Wheelwright, former borough electrical engineer of Blackburn.

Mrs. Margaret Evershed, widow of the late Mr. Sydney Evershed, founder of Evershed & Vignoles, Ltd., died on February 5th, at the age of eighty. Mrs. Evershed took great interest in her husband's work, and joined the board of the company in 1941. She was a member of the Professional Classes Aid Council for several years. In her younger days she was a first-class amateur pianist, having studied in Germany under Madame Clara Schumann.

Mr. G. A. Hughes.—We regret to record the death of Mr. G. A. Hughes, principal and proprietor of the London Electric Firm, Croydon, in his eighty-fourth year after a short illness.

Mr. Archibald N. Lindsay, whose death occurred on February 4th, was chairman of the Scottish Western Electrical Constructors, Ltd., Greenock.

Will.—The **Rev. A. J. Stubbs,** M.Inst.C.E., M.I.E.E., former assistant engineer-in-chief of the G.P.O., who was ordained in 1931, left estate valued at £633.

Voltage Standardisation

Commissioners Decide on 240 V

IN the House of Commons on Tuesdayt, he Minister of Fuel and Power, replying to Mr. Harold Davies, stated that he had considered a report by the Electricity Commissioners on voltage standardisation and that he concurred in the conclusion reached, *viz.*, that " the most practicable and economical method of obtaining complete standardisation of low-voltage AC supplies at one voltage would be to adopt 240 V as the standard, subject for the time being to the present limits of variation (± 6 per cent.)."

In an explanatory statement it is pointed out that the standard is now generally regarded as 230 V, at which 5,602,000 out of 9,880,000 low-voltage consumers were supplied in 1943–44. Of the remainder, 2,108,000 were supplied at voltages below 230 V and 2,170,000 at 240 and 250 V. No fewer than 7,772,000 consumers were supplied at 240 ± 10 V, *viz.*, at 250 or 230 V, owing to the permissible variation of ± 6 per cent. In general, apparatus suitable for 230 or 250 V is suitable for 240 V. Undertakings will be responsible for correcting or replacing apparatus. All new distribution networks throughout the country, even where the existing networks are supplied at a pressure other than 240 V, should be constructed to operate at that voltage.

During preliminary meetings between the Commissioners and representative associations of the industry, one section had favoured as standard a voltage " band " of 230 to 240 V and another 240 V, but at a joint meeting of all the electricity supply and manufacturers' associations, it became clear that the voltage band would be impracticable and that the real advantage of standardisation could be secured to manufacturers only if lamps and apparatus were made for one voltage with the least possible variation.

A determining factor in arriving at a decision has been the technical and financial effect of bringing 250-V supplies down to either 230 or 240 V, taking into account loss of capacity of the distribution systems in addition to costs normally incurred in a change of voltage. To leave the 250-V areas unchanged and to standardise the rest of the country at 230 V was not regarded as satisfactory.

Estimated costs of voltage standardisation were included in a report of the I.E.E. Post-War Planning Committee on Electricity Supply, Distribution and Installation, in January, 1944. These estimates, together with the Commissioners' Statistical Return for 1937–38, formed the basis of calculations in a report, with recommendations, issued by the Joint Committee of Electricity Supply Organisations in March, 1945.

These data have been revised by taking the number of consumers supplied at each voltage in the year 1943–44, the capital expenditure on distribution systems being increased *pro rata*, and by bringing the estimated cost of alterations in excess of 10 V to present price levels, *i.e.*, by increasing the I.E.E. figure of £6·33 per consumer to £10. Where an alteration does not exceed 10 V, the I.E.E. took a figure of £0·57 per consumer on the basis of 1939 costs, but the Commissioners consider that the average expenditure on the raising or lowering of voltage by 10 V would not exceed 5s. per consumer at present-day costs.

The estimated net cost of AC standardisation at 230 V is £26·43 million and at 240 V £18·49 million. The realisable value of the increased or decreased capacity consequent on a change of voltage has been taken as 40 per cent. of the theoretical value. The bulk of the expenditure on standardisation, either at 230 or 240 V, would be incurred in altering systems now below 220 V, the estimated cost in either case being £18·5 million, whereas the estimated cost of bringing down the 250-V supplies to 230 V would be £9 million and to 240 V, £0·22 million.

CORRESPONDENCE

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for correspondents' opinions.

Plugs and Sockets

I AM much obliged to Mr. Astbury for the correction contained in his letter in your issue of February 1st. I find I inadvertently misread the Press statement because it also mentioned a figure of 13 A.

No doubt a test at 15 A was adopted due to the fact that the special fuse-pin plug mentioned was designed for a load of 3 kW, and since a substantial number of consumers are still on 200-V mains it would be necessary for such a plug to be good for 15 A.

Edinburgh. J. F. FIELD,
Engineer and Manager.

Choice of Textbooks

I HAVE been looking without success for textbooks dealing with the design of AC motors and of fractional-horse-power motors.

The book I have in mind is one similar to "Direct-Current Machine Design," by A. W. Hirst, published by Blackie & Son, Ltd., where a complete design procedure from start to finish is given; *e.g.*, the various steps in the design of a 45-HP, 600-r.p.m., 460-V compound machine are shown. I should be grateful for any help your readers can give me.

London, S.W. "VERNON ROYAL."

Technicians for the Mines

THE scheme outlined in your January 11th issue, surely suggests that after acquiring a certain academic standard the men involved would automatically fill technical official positions, and this is exactly what your correspondent "Colliery Engineer" deprecates when such a suggestion is made with regard to similarly qualified mining craftsmen.

What guarantee, or prospects, are to be offered to these when trained men within the industry cannot obtain advancement? Raising the number of trained men without increasing the opportunities will increase the discontent to which "Colliery Engineer" draws attention. The only way to avoid this would be to allow such men to go to other industries which are able, and willing, to give them the opportunity to develop and prove their ability to take responsible positions, but this would completely defeat the scheme's objects.

The "anti-boss" attitude referred to, and with which I thoroughly disagree, would be met by nationalisation; other qualities required—perseverance, resourcefulness and devotion to the object in view—are surely shown by young mining craftsmen who must usually obtain higher technical qualifications by attending evening classes at a technical college some considerable distance from the mining village.

So long as I am personally aware that there are colliery craftsmen unemployed and that others with technical qualifications are unable to obtain suitable positions, my opinion will be that the industry has sufficient men of both grades.

Morpeth, Northumberland. G. A. ROSS.

Electricity Supply Clerical Staffs

MY proposal for the formation of an Electricity Supply Clerks' Association and Mr. Boston's interesting suggestions have prompted me to test the possibility of such an Association. May I ask all who are interested to send any useful suggestions to me at "Mirebrook," Copthorne Bank, nr. Crawley, Sussex, with a view to forming a committee and appointing a secretary to start the organisation. G. A. SIMMONS.

Stand-by Storage Batteries

WITH reference to the correspondence in your issue of January 11th about the possibility of using batteries for supplying three-phase AC, surely a three-phase, grid-controlled, mercury-arc rectifier, acting as an invertor, will perform that function.

Clydebank. RONALD GILL
Electrical Artificer.

Low Quality Coal

Addressing the Coal Industry Society on Monday, Sir John Dalton (County of London Electric Supply Co.) said that bad coal was costing the electricity supply industry over £2,000,000 a year. Referring to the Coal Industry Nationalisation Bill, Sir John said that it held no prospect of cheaper coal. Moreover it would put the State into competition with the electricity supply industry with regard to domestic heating; he contended that as drafted the proposed Coal Board could produce and supply electricity. The electricity supply industry would make urgent representations to the Minister of Fuel and Power for protection as consumers.

Unified Boiler Control—II

Adaptation of the System to Pulverised Fuel Plants

By W. Szwander, *El. Engr. (Warsaw), M.I.E.E.*

IN Part I of this article which appeared in last week's issue, certain features typical of pulverised-fuel boiler control schemes were discussed. In addition there are a number of factors affecting the final form of the scheme adopted in any particular case. The requisite supply of DC may be obtained from either motor-generators or grid-controlled mercury-arc rectifiers; in the latter case quick-break circuit-breakers are needed to take care of possible back-firing.

Complete Schemes

Either one or two converting sets per boiler may be used. With one set per boiler, a separate starting set (common to a number of boilers) is essential and in order to increase overall boiler availability it is an advantage to arrange transfer connections, so that the motors of one boiler may be supplied from the converting set of another boiler (or from the stand-by set, if provided). With one motor-generator per boiler, no circuit-breakers are required in their armature circuits, the protective devices de-energising the whole system by opening a circuit-breaker in the exciter field circuit.

When two sets per boiler are used, whether rectifiers or motor-generators, it is usual to equip them with circuit-breakers, so that by use of suitable protective devices in case of a failure of one set or of the AC supply to it, the boiler may be still operated with the other set; thus with separate AC supplies to each set reliability is increased.

For schemes with two converting sets per

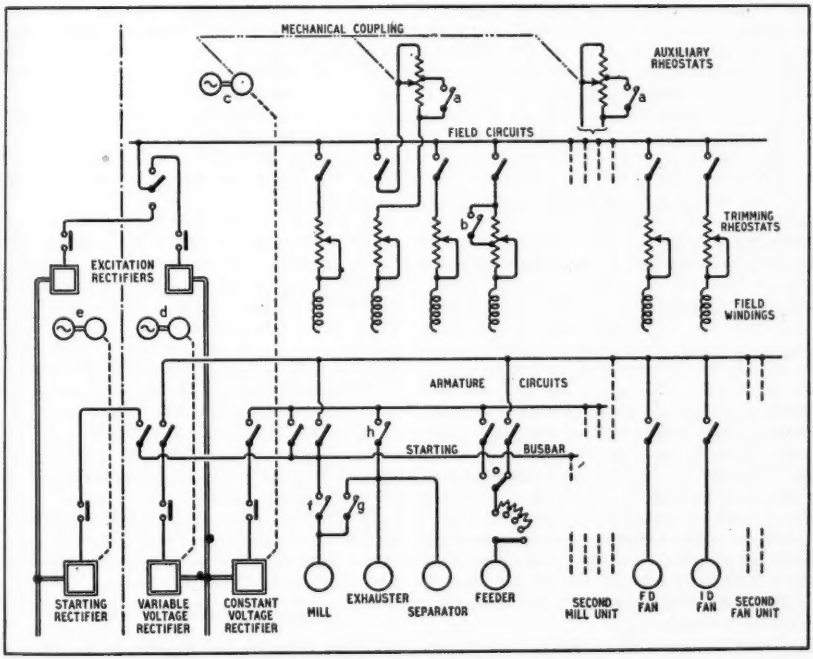


Fig. 4.—Simplified single-rectifier scheme with separate starting set

boiler either single or double busbars may be used. A scheme with single busbars is illustrated in Fig. 5 (where there is one busbar for the variable voltage, one for the constant voltage and one for starting). A double-busbar scheme (with double busbars for both the constant- and the variable-voltage systems) provides the greatest degree of switching flexibility, but it also requires a comparatively large number of selector isolating switches, while more actual switching operations are to be performed; also circuit-breakers are usually provided not only for all the converting sets but also for individual motor groups such as the mill units and the fan units.

Switchgear

The type of switchgear used and the method of operation also influences the final details of any particular scheme. Two distinct types of switchgear can be used, *viz.*, open-front slate-panel units and totally enclosed sheet-steel cubicles. The first must be located in reasonably dust-free premises and is used mainly with two-set schemes, when most of the switching operations for starting and stopping the individual mill units, etc., may have to be performed at the switchboard itself. Isolating and selector switches in this case consist of easily accessible knife switches. Such a switchboard must be in proximity to the boiler firing floor to facilitate the operating of the boiler during which the need for switching may occur fairly frequently.

In the cubicle type of switchboards, which can be made reasonably dustproof and, therefore, can be located in any convenient part of the boiler-house, only such equipment can be mounted as is either operated very infrequently (*e.g.*, only during boiler stand-still periods), or which can be operated remotely from the boiler control panels (*e.g.*, electrically-operated contactors and circuit-breakers for stopping and starting individual mill units). In view of the above, cubicle type switchboards are not easily made suitable for two-set and particularly double-busbar schemes. All apparatus in them is mounted behind dustproof bolted doors and is not directly hand-operated, unless in a de-energised state, the isolating switches usually taking the form of isolating links (bolted or with jaws), whereas all contactors and circuit-breakers must be electrically operated.

The diagram in Fig. 4 illustrates a typical single-set rectifier scheme with a separate starting set, whereas in Fig. 5 a typical two-set, single-busbar, motor-generator scheme, with starting through a separate busbar is represented. When a mill unit has to be started in the latter case, one of the constant-voltage generators must be disconnected from the main busbars (with the position of the change-over switch m, indicated in Fig. 5, the m.g. No. 1 is disconnected); after its voltage has been reduced to zero, it is connected through contactor n to the starting busbar. With contactors f and g closed, the motors of the mill unit are run up to speed by steadily raising the generator voltage and, when equality of voltages of the generators on both m.g. sets is reached, the contactor h is closed. The contactor g is for stopping the mill motor in emergency only, when the exhauster and separator are required to continue running. Before the subsequent starting operation the contactor h must first be open and then the contactor g closed.

Contactors a and b serve the purpose of modifying the feeder-motor and exhauster-motor speed characteristics by the method explained more in detail in Part 1. The diagrams in Figs. 4 and 5 are in simplified form and do not show details of protection, control, interlocks, etc., usually provided to ensure safe operation. Thus, in the scheme of Fig. 5 a motor-generator cannot be started unless the potentiometer rheostats of both its DC generators are in zero-volts positions. None of the generator circuit-breakers can be closed, unless the voltage across it is less than some 50 V.

When using a generator for starting a mill unit, the contactor n cannot be closed till the main generator circuit-breaker is tripped; contactor f cannot be closed till the contactor g is closed and contactor h open and unless the constant-voltage-generator rheostat of the proper m.g. is in the zero-volts position. Further safety devices consist of interlocks to prevent the starting of any of the feeders unless the draught-fans are already running (to minimise the danger of explosion) and to ensure that, with one fan unit tripped, the total fuel quantity brought into the furnace is correspondingly reduced.

By these and other measures the operation of the scheme is made practically foolproof, and a large degree of simplicity of operating the boilers is also ensured.

Automatic Boiler Control

When required, the unified boiler control system, which in itself is not an automatic

boiler control system, can readily be supplemented by the devices required for automatic control. In principle, only an automatic steam pressure controller is required. When the steam pressure in the boiler outlet or in the main steam receiver deviates from its normal prescribed value, this controller sends out electric or other impulses causing the main boiler load controlling device of the unified control system (rheostat or phase shifter) to move in the direction required for counteracting the change. The co-ordination of the individual boiler auxiliary drives, which is the inherent feature of unified control, then ensures at all times satisfactory relations between fuel and air quantities as well as between induced- and forced-draught values.

Hand-trimming of the individual motors may be necessary in the unified control system for two reasons. The first is when the actual boiler-requirement curves for various auxiliary services differ from the assumed or calculated curves on which the design of the motors for unified control has been based. The second is when constant parameters of the design undergo some changes during boiler operation, *e.g.*, when the coal quality changes or when the boiler passages are becoming sooted up. Additionally the motor-speed characteristics in the unified system are usually matched only over the normal operating range of say 50 to 90 per cent. of maximum continuous rating, and outside this range individual hand-trimming may be required. This, however, is also the case with most automatic boiler control systems, which are not designed for operation outside the normal boiler range.

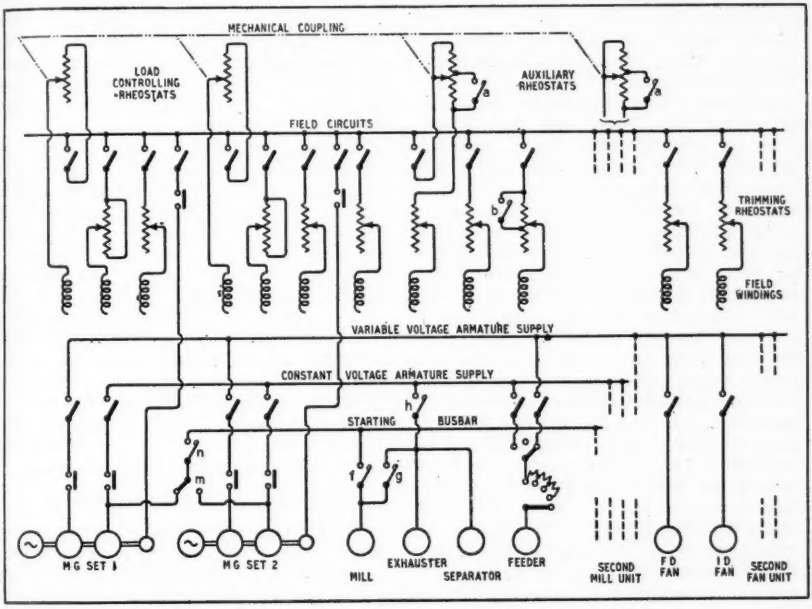


Fig. 5.—Connections for two-motor-generator scheme with starting busbar

Additional automatic "trimming" controllers which may be provided are not an indispensable component of an automatic boiler control scheme but rather a refinement in some instances; the degree of automatic control required in each particular case, apart from the problems of reliability and of cost, depends on the comparison of the amount of labour involved in direct supervision and hand control of the boiler and supervising and maintaining the automatic controllers.

Automatic trimming controllers usually consist of the following: (1) The furnace-pressure controller, measuring the pressure difference between the furnace and the surrounding atmosphere and keeping it

within prescribed limits by adjusting the field rheostats either of the f.d. or of the i.d. fan motors or of both of them simultaneously in opposite directions; in this last case the total amount of air supplied to the combustion chamber is not affected by the trimming operation. (2) The fuel/total-air-ratio controller, which compares the total quantity of fuel going into the furnace (*e.g.*, the sum of the speeds of all the feeder motors by tachometer generator measurement) with the quantity of air delivered to the furnace by the f.d. fans. When the ratio deviates from a predetermined figure, the field rheostats of the feeder motors are suitably adjusted; the ratio, which is pre-set to ensure the best combustion conditions, may be adjusted by cam to vary with the boiler load. (3) The mill-congestion controller, which prevents the choking of the mill with coal. In principle the speed co-ordination between the feeder and the exhauster motors ensures a balance between the coal quantity coming into and going out of the mill. The same speed co-ordination arrangement ensures also the proper quantity of primary air for carrying pulverised coal from the mill to the burner, as well as the suitable proportioning of the coal/air mixture for maintaining the correct size of the flame from the burner. If the balance is disturbed by varying coal quality or by irregularities of feeder operation, the imminence of mill choking can be indicated by a differential pressure gauge measuring the ratio of air pressure drop across the coal layer in the mill to the quantity of air flowing through the mill. Either hand-trimming of the feeder motors can then take place or an automatic controller measuring the above ratio can temporarily reduce the feeder speeds whenever the mills tend to become overfilled.

Advantages over Automatic Sequential Control

It is claimed that superimposing automatic controllers on a system of unified boiler control has advantages over the usual automatic sequential control of fuel flow, induced draught, forced draught and primary air, when these services are not co-ordinated first, as in case of unified control. The main advantage of the unified control system supplemented by automatic controllers, is that a failure in operation of any of the automatic controllers does not mean the breaking of a series link in a chain of functions that is indispensable for satisfactory operation of the boiler controls, but only the absence of trimming, which is of secondary importance, the main controlling operation being always ensured.

Also when operating a boiler temporarily with the automatic devices out of action (as during boiler starting periods) the automatic unified system preserves all the advantages of operational convenience, of auxiliary power economy and of the efficient combustion of the unified system, which is so marked an advantage in comparison with independent control of the individual services, in the case of automatic systems not based on the principle of unification.

Though the term "automatic boiler control" usually includes also the automatic steam-superheat control, which nowadays has become an integral part of the equipment of all large boilers, this problem will not be discussed here, because automatic steam superheat control is obtained by means other than by controlling the motor-driven boiler auxiliary services. It is worth stating, however, that in operating conditions of a boiler controlled by the unified system, due to the steadiness of operation and to the smoothness of all occurring load changes, the task of satisfactory steam superheat control will always be easier than in the case of independently adjusted boiler auxiliary services.

Immunity from Frequency Drops

With unified boiler control the speeds of auxiliary motors can be maintained when the frequency of the AC power supply drops below normal by designing the exciters with some extra margin of field control, so that if the motor-generator speed is reduced, the nominal voltage of the field supply can be restored by rheostat adjustment. The same applies to the main DC generators, with a view to enabling them to deliver the required voltages despite the reduced speed (though with unchanged voltage of the field supply). Thus with a drop of system frequency only the rheostats of the exciters and of the main generators must be adjusted, the motors continuing to run with the same speeds as at normal frequency.

While motor-generators are affected by frequency changes, but practically not by variations of the voltage of the AC supply, with mercury-arc rectifiers the opposite is the case, and extra margins of DC voltage adjustment by grid control would be required to compensate for any AC system voltage irregularities.

Any system-frequency reduction is always a result of deficiency of generating plant

capacity in the system, whether it is temporary, due to some system disturbances or unexpected loads, or of a more permanent character as in some periods of the war in this country. At such times it is most important to be able to get the maximum available power out of the plant in service, and the unified boiler control system making the motor speeds independent of the system frequency is in this respect exceptional. It is easy to imagine that, without this feature, in certain circumstances a complete system collapse might take place when the reduction of frequency caused by generating plant shortage slowed down the boiler auxiliary motors, which in turn would cause still further reduction of the generator power and therefore also the frequency, and so on in a vicious circle.

In unified boiler control the immunity from frequency drops, referred to above, is obtainable at the lowest possible cost and with practically no sacrifice of the efficiency of the drives in normal operational conditions. This sacrifice is considerable when other methods of fan control are used in which the increased range in the upper region of motor-speed variation or output control margin can be obtained only at the cost of increased losses (for example, in variable speed couplings or dampers) in the normal boiler operating range at normal system frequency conditions.

BIBLIOGRAPHY

J. W. Young and G. A. Eastwood, " Unified Boiler Control—Application of Variable Voltage to Boiler House Auxiliary Control " (*Journal*, Institute of Fuel, April, 1937). J. W. Young, " Unified Boiler Control Equipment at the Roan Antelope Copper Mines " (*M.V. Gazette*, July, 1941, p. 172); " Central Control for Boilers " (*Engineering*, December 11th, 1942, p. 461); " The Scientific Control of Combustion " (*Mining Electrical & Mechanical Engineer*, December, 1943, p. 213). W. Szwander, " Unified Boiler Control System " (*M.V. Gazette*, January, 1945, p. 23).

Post-Graduate Engineering

Authoritative Views on Training Courses

IN opening a discussion on " Post-Graduate Courses in Electrical Engineering including Radio " at the Institution of Electrical Engineers Radio Section on January 22nd, Professor Willis Jackson and Professor J. Greig stated that the primary aim of the full-time university degree and part-time National Certificate courses (which give exemption from the I.E.E. examination) was a broad understanding of scientific and engineering principles in relation to electrical engineering practice. With the increasing scope of fundamental scientific knowledge, continuous contraction must occur in the technological content of these courses; at the same time, technical development was increasing rapidly.

The acquisition of the extensive specialised knowledge necessary could no longer be left to the unaided initiative of the recruit to industry who was as much in need of systematic guidance as he was at the university. His needs could best be met by post-graduate courses conducted by experienced teachers and by senior representatives of industry.

The relative merits of full-time or part-time day or evening courses varied with the scope of the subject, the need for laboratory work, the desirable duration of the course and the seniority of those concerned. Effective post-graduate study required some background of industrial experience. Junior employees could, no doubt, be released for uninterrupted periods of a few weeks or possibly months and senior men could attend part-time day courses while retaining an effective hold on their responsible positions in industry. Evening courses should be avoided if possible.

Engineering consisted essentially in the development of techniques, for which the engineer required an expanding basis of scientific knowledge. Some post-graduate courses would therefore deal with advanced mathematical physics, *e.g.*, electric field and circuit theory, probability theory and its applications, theories of electronic emission and electron optics. Other courses would make no greater demand than that provided by university degree and Higher National Certificate courses, and would deal with techniques, sometimes highly specialised, for design of equipment or for analysis of the performance of systems. A third class of advanced course would be concerned with such subjects as industrial relations, the Factory Acts and patent law.

The co-operation of industry in the guidance of those responsible for advanced teaching and in the provision of the material resources was as necessary to the success of post-graduate work as was the enthusiasm of the young engineers for whom, in the main, such courses would be provided.

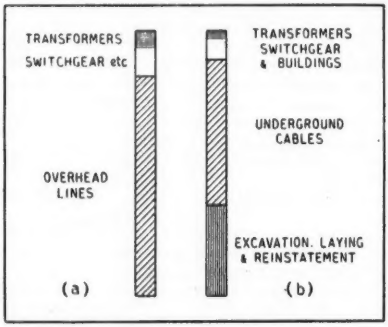
In his reply to the general discussion, Professor Greig suggested that the main need was for advanced theoretical training and that it was necessary to educate managements into a realisation that the future of British industry depended upon raising the technical quality of the mass of the population.

Automatic Voltage Regulation

Its Extending Field on Distribution Networks

IN this country voltage in a distribution network has usually been maintained reasonably constant by installing cables and lines of sufficient cross-section and by erecting substations sufficiently close together. It has been stated that " it may be taken as axiomatic that distributors can never be loaded to the thermal limit because of voltage limitations " (*a*) and that " the factor determining the sectional area of the conductor is almost always the permissible voltage drop " (*b*). Alternative methods of voltage control are automatic voltage regulators and on-load tap-changing.

The diagram compiled from references (*a*) and (*c*) shows diagrammatically the relative costs of lines, transformers and switchgear in typical rural and urban distribution systems. These are based on pre-war values, but as a comparison they hold good for present-day values. Transformers and voltage regulators are comparable in cost, which is small compared with that of lines and cables. Automatic voltage regulators could therefore be installed throughout the distribution system for an extra expenditure of less than 1 per cent. of the total cost of supply, without reckoning advantages of automatic voltage regulation or savings effected in lines and cables. Thus, " with a regulator one can roughly double the capacity of the network " (*d*) and " it might be advantageous if supply authorities had means of automatic voltage regulation incorporated in all new transformers installed " (*e*).



Capital costs of (*a*) rural overhead system; (*b*) urban underground system

In general, voltage drop imposes similar restrictions on the loading of high-voltage networks, although the limit may not be reached so frequently. The economic desirability of automatic regulation will depend upon the total loading and extent of such networks. " Generally speaking the size of H.T. conductor to be adopted is governed by the voltage drop " (*a*). " There may be a voltage variation at the L.T. busbars of from 4 to 8 per cent. where 11,000-volt transmission is employed " (*f*).

The following examples from reference (*f*) illustrate the economic advantages of automatic regulators over heavier medium-voltage cables and over additional high-voltage substations. First, " on a 4-core 0·5 sq. in. feeder, 300 yards in length, carrying 75 per cent. full load, the voltage drop at the feeding point would be approximately 13 volts between phases. An expenditure of £800 on L.T. cables would only reduce this drop to 6·5 volts, whereas a compounded regulator costing £200 would not only entirely eliminate the voltage drop on the feeder, but could be arranged to compensate for part of the pressure drop on the distribution as the load increased."

Secondly, " consider the case of an estate developing slowly 1,000 yards distant from an existing distribution centre. To extend the E.H.T. networks and install a new centre on the new estate would cost approximately £2,000, excluding distribution costs. An L.T. cable which would ultimately be required as a distributor could be laid from the existing distribution to the network supplying the new estate for a cost of £400, and apart from voltage drop would be quite capable of supplying the new estate. By installing a pillar type voltage regulator on the L.T. cable it is estimated that supply could be maintained from the L.T. distribution for four years. The regulator would cost approximately £140, but when it was no longer required it could be removed and used elsewhere on the network. The cost of installing and removing it would be £35. Thus, at a cost of £35, a capital expenditure of £2,000 could be deferred for four years and a net saving of £410 in annual charges effected."

Practical examples of the increase in

revenue obtained by installing automatic voltage regulation are given in references (*g*) and (*h*). In reference (*j*) an increased consumption of 10 per cent. is estimated if the voltage is maintained constant on load.

A more detailed example from reference (*f*) states—

"Assume that a suburban network, with 1,000 consumers connected, is supplied from one distribution centre. On 60 per cent. of the connected apparatus the total consumption would vary as the square of the voltage. If the average voltage of 500 of those consumers farthest from the distribution centre was increased by 4 per cent., the aggregate consumption of these 500 consumers would be increased by approximately 10 per cent.

"In suburban areas, due to the two-part tariff, revenue is not directly proportional to consumption but, omitting the fixed charge, an average revenue of £5 per annum per consumer may be assumed, or a total revenue from the 500 consumers of £2,500 per annum, due to consumption of energy alone. A £250 increase in revenue would therefore be obtained from a 4 per cent. increase in the average voltage to 500 consumers.

"After deducting the cost of production, a sum would remain which capitalised would be sufficient to pay for the installation of automatic voltage regulating equipment at a principal substation, L.T. distribution centre, a number of points on the L.T. network, and still leave a considerable profit."

The whole effect of larger mains and more frequent substations is to reduce the voltage drop in the mains themselves. Automatic voltage regulation can also be used to compensate for voltage drop in transformers, which can thus have greater reactance and voltage regulation. The transformers themselves are then cheaper whilst the greater reactance permissible limits short-circuit currents and permits cheaper switchgear of smaller rupturing capacity. The latter effect has become of considerable importance in recent years due to supplies from large power sources of large short-circuit capacity.

Feeder filler containing 100-kVA, 400-V, three-phase automatic voltage regulator

In planning a distribution system or extensions, a forecast of the growth and extension of load must be made, the layout being based on a compromise between initial requirements and assumed future developments. The decision is largely a matter of speculation. Whereas expenditure on lines, cables and substations provides a rigid solution which cannot be adjusted if the actual loading varies greatly from that assumed, automatic voltage regulators permit rapid adaptation of the system to sudden load developments. Cables and substations are neither portable nor interchangeable.

It is suggested that automatic voltage regulators should be standardised by supply authorities in one or two sizes. They can then be installed quickly as conditions require, and can be moved elsewhere if the load varies. The layout of the system can thus be planned without the strict regard for voltage regulation otherwise necessary and the economic case becomes a comparison between the annual cost of the regulator and the saving in capital cost of new substations and mains for some years. Where the voltage is regulated on the higher-voltage side of substation transformers there is a saving in no-load loss during long periods of light load (*e.g.* at night) when the voltage is normally high, since the flux density in the transformer is maintained constant instead of rising with the voltage. We are indebted to Mr. E. T. Norris of Ferranti, Ltd., for the foregoing information.

REFERENCES

(*a*) *I.E.E. Journal*, 1934, Volume 74, p. 285, Kidd and Carr.
(*b*) *I.E.E. Journal*, February, 1932, Dickenson and Grimmitt.
(*c*) *I.E.E. Journal*, Volume 65, p. 338, Beard and Haldane.
(*d*) *I.E.E. Journal*, July, 1936, p. 52, H. W. Grimmitt (discussion).
(*e*) *I.E.E. Journal*, November, 1932, p. 769, Blades and McQueen.
(*f*) *E.P.E.A. Journal*, November, 1936, McQueen.
(*g*) *I.E.E. Journal*, June, 1934, p. 540, F. H. Naylor.
(*h*) *I.E.E. Journal*, July, 1936, p. 33, F. H. Naylor.
(*j*) *I.E.E. Journal*, 1934, p. 285, Carr.

Electrical Mining Plant

Experience with Lease-Lend Equipment

ELECTRICAL aids to coal production were considered at last month's informal meeting of the Institution of Electrical Engineers. The subject was introduced by MR. R. CRAWFORD, who confined his remarks to plant used underground, pointing out that greatest increase of installed HP occurred in the decade immediately preceding the war. The most striking development during that period was the addition of over 400 per cent. to the HP of face and gate loaders and conveyors while in the same period increased use of coalcutters accounted for a growth of 78 per cent. in connected load.

A possible corrective of the small output of coal per man-shift worked was the application of more machinery at the face. That view was strongly supported by experience in America, so Lease-Lend facilities were invoked to provide Britain with several million pounds worth of American plant during the war years. Quick results were not to be expected from that experiment because it meant reverting to a system of mining which Britain discarded years before. But Mr. Crawford had no doubt that loss of output due to falling manpower would have been much more serious if that effort had not been made with American plant.

Types of American Plant

The most important appliances brought over were the caterpillar-mounted mobile loading machine and the rubber-tyred shuttle car; both introduced fresh electrical problems, some of which conflicted with established British practice. For example, many of the loading machines had unit drives, employing up to five motors, which prohibited the use of remote control; while shuttle cars were driven by accumulators, which necessitated the installation of flameproof battery-charging equipment at the coal face, and little of the imported plant was suitable for connection to some of the larger types of trailing cables to which the British industry had become accustomed.

The imported machines had given good service during the three years they had been in use; there had been few mechanical or electrical failures, dispite the somewhat frail appearance of some of the electrical equipment; it had been sufficiently successful in service to justify its manufacture in this country.

The American mobile loader dispensed with shovel loading, but it necessitated a change in the British method of mining. Since much "longwall" mining could not be changed-over to the American "room and pillar" method, British manufacturers had been developing loading machines more appropriate to British requirements. They had gone further and designed a machine that undercut the coal, then tore it down without the aid of drilling for explosives and also loaded it on to the conveyor, thus completing the whole process in one operation. Such a complex machine could, at present, only be applied to a limited range of geological strata.

The standardisation of voltage (seven values were in use at present) and increase of underground transmission (probably up to 6·6 kV) to cater for growing load at the coal face was very desirable.

Municipal Electricity

A MEMORANDUM on the contribution of local authorities to the development of the electricity supply industry has been issued by the Incorporated Municipal Electrical Association. It is claimed in a foreword that the I.M.E.A., with a membership of 349 undertakings (listed in an appendix), represents 95 per cent. of the local authorities in Great Britain and Northern Ireland owning and operating electricity undertakings. Public authority undertakings are shown in a table to have been responsible in 1937-8 for 67·8 per cent. of the consumers connected and 63·1 per cent. of the kWh sold (excluding bulk supplies).

It is claimed that the method of financing local authority undertakings ensures proper provision for the repayment of capital debt and minimum interest, with consequent cheapening of electricity to the consumer.

After demonstrating that these undertakings have been foremost in the development of electricity the Association expresses the opinion that a drastic scheme of reorganisation of local authority undertakings is unnecessary. It recommends a policy of organised co-operation between them and the introduction of uniform service to all consumers. An extension of public, and in particular local authority, ownership is advocated, it being contended that by this means the needs of the community will best be served.

COMMERCE and INDUSTRY

Engineering Wages and Conditions. Use of Atomic Power.

A.E.U. Wage Claim

AT a meeting between representatives of the Engineering Employers' Federation and the Amalgamated Engineering Union last week the Union asked for an increase of 20s. per week in the basic rate of members with corresponding increases in the wages of piece workers. Coupled with it was a claim for a five-day week of 40 hours, a fortnight's annual holiday with pay and payment for six statutory holidays. It was also requested that the guaranteed week, which was one of the conditions of the Essential Work Order, should be continued when the Order ceased to operate in May.

After the Union's case had been presented by Mr. J. Tanner, its president, the conference was adjourned for the employers to consider their reply.

South African Imports

The official statistics of the foreign trade of South Africa for 1943 show that a further decrease occurred in the electrical import trade of the Union. Some of the more important totals, with figures for 1942 in parentheses, were:—Motors, £360,000 (£296,000); transformers, £210,000 (£200,000); other electrical machinery, £1,263,000 (£1,213,000); cable and wire, £297,000 (£458,000); lamps, £290,000 (£288,000); radio material £84,000 (£321,000) and heating and cooking apparatus £22,000 (£103,000). The United Kingdom was the largest supplier with the United States next although some way behind. Switzerland's share was small but worth noting in motors and radio goods. Newcomers in a modest way were Brazil, with parts for batteries, and Argentina with heating and cooking apparatus.

Future of Atomic Power

In the opinion of Professor P. M. S. Blackett, who has been prominently associated with research into atomic energy, the replacement of present means of producing power by atomic energy was dependent upon the provision of sufficient usable uranium (235 and 238) or of other sources of atomic energy. He said that to supply the amount of electric power at present produced by means of steam and water power 10,000 tons of uranium would be required. Other possible sources were thorium or the conversion of hydrogen into helium.

Present methods involved the liberation of an immense amount of heat but this was "low-grade," probably less than 100 deg. C. For power production it would be necessary to raise the temperature of the extracted heat so that it was available in the form of steam. The chance of succeeding in doing this within a reasonable period, say ten years, was sufficiently great to justify every effort to achieve it. At the same time Professor Blackett considered that researches into other forms of power production should be continued.

"Electrical Review" Index

Copies of the index of Volume CXXXVII (July–December, 1945) are now available from the Publisher, *Electrical Review*, Dorset House, Stamford Street, S.E.1.

Radio Industry and Television

The Radio Industry Council says that the television plans of the radio industry are detailed and definite with 100,000 new television receivers scheduled for production, representing a retail value of about £5,000,000. The firms which supplied the 20,000 sets which have lain idle since 1939, are planning to give full help in the overhaul of these sets. The aim is to have 120,000 television owners by the end of the B.B.C.'s first year of resumed transmission.

Hostel for G.E.C. Apprentices

Presiding at a dinner of the General Electric Company's Apprentices' Association held recently, Mr. J. J. Gracie, joint managing director, said that the company was negotiating for a lease of Castle Bromwich Hall, an Elizabethan mansion, for use as a hostel, club and training school. Accommodation could be provided for boarding between thirty and sixty apprentices, particularly those in their first year who did not live in Birmingham. Mr. Gracie

Castle Bromwich Hall, an Elizabethan mansion, for which the G.E.C. is negotiating for use as a hostel for apprentices

added that it was proposed to raise the standard of apprenticeship to the highest in the country, so that it would become a difficult matter, and an honour to be won, to secure entry to the G.E.C. as an apprentice. We are grateful to the *Birmingham Post* for permission to reproduce the accompanying view of Castle Bromwich Hall.

Badly-handled Appliances

Speaking at a meeting of the Electrical Association for Women last week, Mr. W. E. Swale, sales manager of the Manchester Corporation Electricity Department, said that the Department had about 18,000 electric kettles on hire and each of them was returned for repair once a year on the average. A reduction in the cost of maintenance would lower costs to the consumer he said and he gave further instances of the bad handling of equipment, such as the upsetting of water and grease over cooker hotplates and the leaving-on of these plates without a covering utensil. Examples of misused appliances were displayed at the meeting.

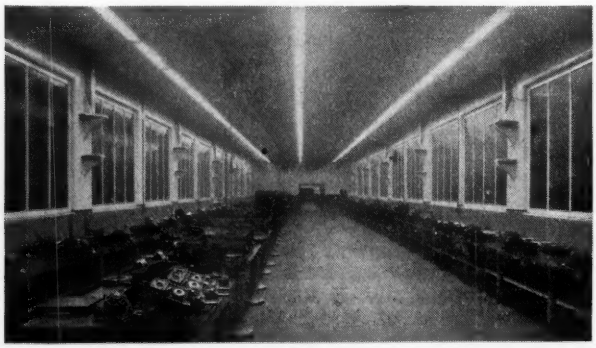
Trade with Malaya

Private trade between the United Kingdom and Malaya is now permissible in goods for which the Malayan authorities have granted an import licence subject, of course, to compliance with any export licensing or other requirements in the United Kingdom.

Eliminating Specular Glare

Appreciating the benefits of good lighting Vickers-Armstrongs, Ltd., have recently brought up to post-war lighting standards a section of the fitting and assembly shops at the company's Elswick Works, using 80-W 5-ft. fluorescent lamps in three rows of "Metrovick" continuous troughing mounted directly on the ceiling 14 ft. high. As the equipment handled is largely "VSG" pumps and transmission gear units with highly polished components the elongated light source of the fluorescent lamp with consequent low surface brightness was considered particularly suitable. To obtain a similar value of illumination, approximately 30 lumens per sq. ft., with small high intensity light sources would have caused objectionable reflected glare of a specular nature from the multitude of polished surfaces. The shops are air conditioned and the low temperature operation of the fluorescent lamp was a further point to recommend its adoption.

The scheme was planned by the illuminating engineering section of the Metropolitan-Vickers Electrical Co., Ltd., and the actual wiring and installation work was performed by the works' own electrical staff.



Fitting and assembly shop lighting at Vickers-Armstrong Elswick Works

Large New Cooker Factory

A munitions factory at Swinton, near Mexborough, Yorkshire, has been taken over from the Government by the General Electric Co., Ltd. for the manufacture of electric cookers and it is expected that production will be commenced in the next few months. The company claims that this will be the largest factory in the British Empire devoted solely to the manufacture of electric cookers; it will employ over 2,000 people. Although a certain number of production experts and key workers will be transferred to the new site from the Magnet Works at Birmingham, the majority of staff and workpeople will be local. The effect of this will be to introduce a new light engineering industry to an area which is almost exclusively devoted to heavy engineering.

The Birmingham works, where G.E.C. cookers were previously made, will now concentrate on the production of a wider variety of other domestic appliances than was available before the war.

Mine-Lighting Display

A small-scale exhibition of underground colliery lighting, officially opened last week by Mr. Robert Foot, chairman of the Mining Association of Great Britain, was arranged primarily to enable members attending the annual general meeting of the Institution of Mining Engineers to see alternative means of illumination. In the laboratories of the British Colliery Owners' Research Association at the Royal School of Mines (Imperial College), South Kensington, there had been erected an imitation coal face to demonstrate mains lighting, including experimental fluorescent-tube fittings, as well as pneumatic-electric lamps, transportable (battery) reflector-flood lamps and different kinds of miners' hand and cap lamps. Practical advantages to be gained from the use of white dust and whitewash in increasing reflectivity, reducing shadow contrast and diminishing glare were demonstrated. The relative efficiency of mercury vapour, sodium, fluorescent and tungsten-filament illumination of conveyors for the separation of shale from coal by hand picking was indicated. Manufacturers represented included the British Thomson-Houston Co., Ltd., General

Electric Co. Ltd., Metropolitan-Vickers Electrical, Co., Ltd., Heyes & Co., Ltd., Ceag, Ltd., John Davis & Son (Derby), Ltd., Concordia Electric Safety Lamp Co., Ltd., Nife Batteries, Ltd., Oldham & Son, Ltd., Wolf Safety Lamp Co., and Philips Lamps, Ltd.

E.L.M.A. Design Courses

Following the successful conclusion of its forty-second illumination design course last week at which the average attendance was over 200, the Electric Lamp Manufacturers' Association has now arranged to hold evening design courses in both London and Leeds. The course in London will be held at the Lighting Service Bureau on six consecutive evenings commencing on February 28th, and is intended to serve as a refresher course for members of the electrical industry, drawing particular attention to the progress made in fluorescent lighting during the war. The Leeds course, the first provincial one since the end of the war, will run from March 7th to April 11th. The subjects of five of the six lectures will be the same at both London and Leeds and will cover "Light and Vision" (E. B. Sawyer), "Illumination Design for Interiors" (A. D. S. Atkinson), "The Development of the Electric Lamp" (A. G. Penny), "Fluorescent Lamps" (C. R. Bicknell) and "Lighting Practice of the Future" (W. Robinson). The sixth lecture in London will be on "Light in the Home" (T. O. Freeth), and that at Leeds on "Factory and Mill Lighting" (J. W. Howell).

Scholarships for Demonstrators

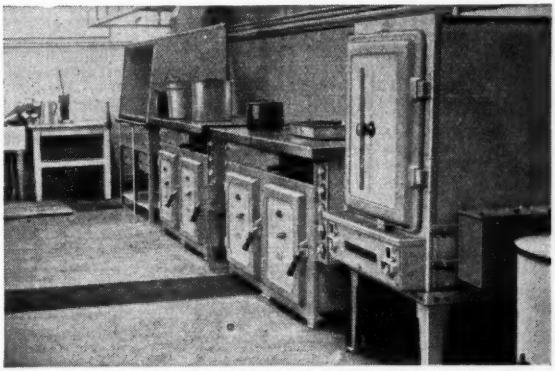
On the recommendation of the electrical engineer (Mr. S. F. Britton) Chester Electricity Committee has agreed to provide a scholarship of £105 every two years to the most suitable applicant from the girls' secondary schools for training as electricity showroom demonstrator at the London School of Electrical Domestic Science. Successful applicants must engage to remain with the Council for three years after conclusion of the course.

English Electric Exhibition at Glasgow

To demonstrate the reconversion of its production from war to peace the English Electric Co., Ltd., is holding an exhibition at Prosser's Showrooms, Bothwell Street, Glasgow, C.2. Photographs and models show how the company made many millions of pounds' worth of wartime products, and give a comprehensive picture of how its wartime activities have enhanced its readiness to meet peacetime needs.

Worsted Factory Canteen

That the introduction of canteens in textile establishments has been justified is manifest by the extension and re-equipment of existing canteens and the introduction of new ones. At the factory of G. H. Mallinson & Sons, Ltd., fine worsted manufacturers, Linthwaite, near Huddersfield, an all-electric canteen has recently been installed to provide 350 cooked meals per day, though many more could conveniently be prepared without taxing the capacity of the equipment. The main equipment of the kitchen is of G.E.C. manufacture and includes two double-oven cooking ranges (each 30·6 kW), two hot-cupboards (each 6 kW), a steaming oven (12 kW), a double-pan fish-fryer (18 kW), a 4·2-kW toaster; and two 10-kW vegetable boilers in addition to 100-gal. water heater.



This canteen equipment provides 350 cooked meals a day

The total capacity of the two ovens is approximately 14 cu. ft. and the available hot-plate area is nearly 9 sq. ft. The dimensions and capacities of the other equipment are of the same generous proportions, so that quick service of really hot and well-cooked food is assured. Most heating elements of the equipment are fitted with variable heat control so ensuring maximum flexibility and correct temperatures. The main dining hall is lighted by "Osram" 80-W "warm-white" fluorescent lamps.

Russians See Cable Factory

A party of Russian Merchant Navy officers and men from a contingent which has arrived in the Mersey to take over ex-enemy ships allotted to Russia, visited the British Insulated Cables factory at Prescot on February 1st under arrangements made by the British Council. The managing director, Mr. G. Bolton, and the works manager welcomed the party, who saw among other things drums of high-voltage cable for Stalingrad and other devastated Russian towns.

Admiralty Thank L.E.P.

Ever since 1943 the Testing and Meter Department of the Lancashire Electric Power Company has been engaged upon an important Admiralty contract. The work is now drawing to a successful close, and recently Mr. O. Howarth, technical adviser to the company, called together all members of the Department to give Lieut.-Commdr. W. D. Sutcliffe, R.N.V.R., an opportunity of thanking the staff

on behalf of the Admiralty. Lieut.-Commdr. Sutcliffe said that the work upon which they had been engaged was of very great importance to communications. Every task had been handled very quickly, but in spite of this every one of the 2,000 equipments which had passed through the Testing Department had stood up to its exacting work. Each member of the Department would be able to look back with pride upon the part he had played.

Visit to B.T.H. Works

On February 5th, members of the Leicester Centre of the Illuminating Engineering Society visited the Rugby Works of the British Thomson-Houston Co., Ltd. The party spent some time in the lamp works, where the manufacture of "Mazda" gas-filled tungsten lamps and fluorescent lamps was studied. In the research laboratories some interesting demonstrations and experiments were seen in conjunction with many types of electric discharge lamps. A brief visit was also paid to the turbine and large machine shops to see the manufacture of large turbo-alternators, and such machines as alternators for hydro-electric schemes, electric ship propulsion motors, and rolling mill motors.

Disposal of Surplus Machine Tools

About 500 machine tools will be available for sale when the Ministry of Supply, Machine Tool Disposals Directorate, opens a further "on site" sale at Vickers-Armstrongs Squires Gate Airport, Blackpool, on February 20th.

Armature Winder's Death

An inquest was held recently on Thomas J. Loach, an armature winder, who was killed at the L.M.S. Railway Company's substation at Ormskirk. He had been sent with an electrician to correct a fault and removed the safety cage before the switch had been isolated. In examining the fault, he caught his forehead on one of the transformers and received a 6,000-V shock. A verdict of "Death by misadventure" was recorded.

Trade Publications

British Thomson-Houston Co., Ltd., Bridle Path, Watford Junction, Herts.—Illustrated bulletin No. 3 (L.785/M), concerned with the infra-red baking of paints and enamels, based on a paper read by Mr. J. C. Lowson last year.

Meritus (Barnet), Ltd., Wood Street, Barnet, Herts.—Illustrated pamphlet (No. 16) containing descriptive specifications of the "Autoforge" spot-welding machines.

Allen West & Co., Ltd., Brighton, Sussex.—Illustrated leaflet (No. 1728) in the form of a "News Letter" giving information about the firm's war effort.

Davidson & Co., Ltd., Sirocco Works, Belfast, Northern Ireland.—Illustrated publication (SF. 372) containing technical information and dimensions of "Aeroto" patent screw fans for industrial and marine requirements.

Trade Announcements

The London office of Brush Electrical Engineering Co., Ltd., and Brush Coachwork, Ltd., is now at Duke's Court, 32, Duke Street, St. James's, London, S.W.1 (telephone: Whitehall 6177; telegraphic address: Magneto, Piccy, London).

Until their new factory at 69, Upper Street, Islington, N.1, is ready, "Beeantee" Illuminations (London), Ltd., have taken temporary offices at 6, Upper Street (telephone: Canonbury 4555).

The head offices of the City of Bradford Electricity Department have been transferred from 27, Bolton Road, to the Department's main showrooms at 45-53, Sunbridge Road.

Electricity Meter and Allied Industries, Ltd., Joynton Avenue, Waterloo, Sydney, have been appointed Australian representatives for the De la Rue group of companies manufacturing plastics. Mair & Co., Christchurch, New Zealand, have been appointed New Zealand representatives.

The Bristol branch office of the British Aluminium Co., Ltd., has moved to 62, Queen Square, Bristol, 1 (telephone: Bristol 23957; telegrams: Britalumin, Bristol).

Calendars

The Edison Swan Electric Co.'s desk calendar is mounted on a wooden base and has, in addition to daily tear-off slips, sheets showing the current, last and next months.

Three months' dates can also be seen at a glance on the desk calendar of Nalder Bros. & Thompson, Ltd.

The Easco continuous progress calendar for 1946 will be found of great assistance in buying and sales offices as well as in estimating, progress and planning departments, etc.

TRADE MARKS

THE following applications have been made for trade marks. Objections may be entered within a month from February 6th:—

ESDEL. No. 636,843, Class 9. Electric batteries and accumulators. Also No. 636,845, Class 21. Kitchen utensils.—Swinton, Dickenson, Ltd., 41, Kentish Town Road, Camden Town, London, N.W.1.

FHL (design). No. 634,283, Class 9. Audio-frequency oscillators, oscillographs, signal generators, valve voltmeters, vibration recorders, amplifiers and electrical bridges; all being scientific or electrical apparatus and instruments.—Furzehill Laboratories, Ltd., Shenley Road, Boreham Wood.

INFORMATION DEPARTMENT

GENERAL inquiries from readers relating to sources of electrical goods, makers' addresses, etc., are replied to by our Information Department through the post. Inquiries should be accompanied by a stamped addressed envelope.

Our extensive records enable us to reply to most queries, but occasionally we ask for our readers' assistance in tracing names and addresses not known to us. We should be glad to have such information regarding the following:—

Bakelite "Summit" hair dryer, actual makers, not factors.

ELECTRICITY SUPPLY

Street Lighting Conversion. Cardiff Biscuit Factory.

Aberdeen.—SUPPLY TO ESTATE.—The cost of work which will have to be undertaken to provide electricity for the Stockethill housing scheme at Aberdeen is estimated at £16,000. The electricity substation to be built will be large enough to become a main high-voltage switching centre.

Barrow-in-Furness.—COMMISSIONERS WITHHOLD CONSENT.—The Electricity Commissioners have informed the Electricity Committee that, having regard to the lapse of time since the various sanctions were issued, and that information could not be furnished at this stage fully satisfying them with regard to the difference between the amount sanctioned and the expenditure incurred, they would not feel justified in issuing any consent to the use of surplus revenue for the over-expenditure on loan sanctions amounting to £6,880. They add that the Council should take steps to arrange that in future any necessary consent either to the use of surplus revenue or to borrowing is obtained before liability for expenditure is incurred.

Birkenhead.—CHANGE-OVER.—The Electricity Committee is to change over from DC to AC in various areas at a cost of £120,827.

Blackburn.—STREET LIGHTING TO BE ELECTRIC.—The Corporation has decided to illuminate all the streets of the town by electricity and to dispense with gas. The change-over, which will cost £10,000 for the current year, will be spread over the next five years.

ELECTRICITY FOR MILLS.—It was reported to the Town Council, on February 6th, that the electrical engineer (Mr. R. H. Harral) had completed the negotiations with J. Duckworth & Sons, Roe Lee Mills, & Robinson, Seed & Co.'s Armenia Mill, for the supply of electric power, the respective costs being £2,656 and £3,321.

Cardiff.—BAKING BISCUITS ELECTRICALLY.—At a meeting of the Electricity Committee the electrical engineer reported that a new biscuit factory being erected at Pengam would be the first to be established in the United Kingdom where biscuits would be baked by electricity and that he was in communication with C. H. Elkes & Sons, Ltd., regarding terms of supply.

INSTALLATIONS IN PREFABRICATED HOUSES.—In view of the nature of the electrical installations in prefabricated houses at Crystal Glen a clause is to be inserted in the supply agreements with the tenants to the effect that as the installations do not comply with the requirements of the Electricity Committee, no responsibility can be accepted by the Council for their safe operation.

HIRE OF KETTLES.—Electric kettles are to be hired to tenants of prefabricated houses at a charge of 2s. per quarter.

Coventry.—LOANS.—The Electricity Committee is seeking sanction to borrow £4,659 for provision of a supply to a factory, £8,754 for plant, etc., at Hollbrook Lane and Abercorn Road substations, and £9,457 for coal storage and handling equipment.

Clay Cross.—STREET LIGHTING CHANGE-OVER.—Substitution of electricity for gas for street lighting has been approved and will, it is hoped commence next month.

Fleetwood.—AMENDED HOUSING PROPOSALS.—Electric cookers and special drying cupboards have been deleted from the plans of 54 permanent houses at Fleetwood, the Ministry of Health considering a tender of £57,212 too high. The revised tender is for £52,631.

Fort William.—HOUSE WIRING.—At a meeting of the Town Council, Bailie Kean said there were instances of potential consumers who had gone to the expense of having their premises wired by inexperienced persons only to find that this wiring did not pass the tests. He hoped that some method could be devised to protect people. The matter was referred to the Electricity Committee with powers to decide what further action should be taken.

Glasgow.—STREET LIGHTING EQUIPMENT.—The Lighting Committee is to approach the appropriate Government Departments with a view to effecting an improvement in the supplies of material urgently required for public lighting.

Hull.—UNDERTAKING'S FINANCES.—When the general manager (Mr. D. Bellamy) reviewed the undertaking's position a year ago there was an estimated deficiency for the current year of £75,000, but a subsequent adjustment of the tariffs by the elimination of the ½d. rate met a little over one-third of this. The position now is that income is expected to meet expenditure, except for appropriations of a special nature which may mean utilisation of reserve fund up to approximately £56,000 for the current and next years. The reserve funds are substantial, exceeding £300,000 and are considerably in excess of the pre-war figure. It is anticipated that the ratio of sales to capital will increase considerably and if nothing abnormal develops it appears probable that the present low price level may be maintained, although existing conditions make the preparation of estimates very difficult.

CHINESE TRAINEE.—The Electricity Committee has agreed to an arrangement with the Federation of British Industries accepting Mr. T. C. Hsu, a Chinese university graduate, as a trainee at the Sculcoates power station for a period of twelve months.

Leicester.—POWER STATION EXTENSIONS.—Extensions to the power station costing £2,330,746 have been approved by the City Council. The first part of the extensions must be completed by September, 1947, and the remainder by September, 1949.

Liverpool.—SUPPLY TO L.M.S. RAILWAY.—The Electricity Commissioners have consented to the Corporation borrowing £31,881 in connection with the supply of electricity to the L.M.S. Liverpool-Southport line.

North-West Midlands.—WORKERS' REPRESENTATIVE.—The Minister of Labour and National Service has given notice that as soon as may be

after February 28th, he will designate to the North-West Midlands Joint Electricity Authority, the employees' organisations having members in the employment of authorised undertakers in the District, in order that the organisations so designated may choose a representative to be a member of the Authority. Any employees' organisation desirous of being considered should apply in writing to the Minister not later than February 23rd, on a form obtainable from the Secretary, Ministry of Labour and National Service, 8, St. James's Square, S.W.1.

Nottingham.—ASSISTED WIRING PROSPECTS.—In reply to a query regarding the prospects of resuming the assisted wiring scheme, Councillor J. Wilbery, stated at a meeting of the City Council that, although the Government had announced the suspensions of the restrictions with regard to the supply of electrical equipment, there were seven priority classes who had first to be catered for. If, after this had been done, there were the labour and materials available then the requirements of the ordinary householder might be met.

Rotherham.—THE YEAR'S PROGRAMME.—The Electricity Committee's capital expenditure programme for the ensuing year includes the following: Building and plant extensions, £268,000; mains and services, £43,000; substation buildings and plant, £25,500; and meters, £2,000.

SUPPLY TO ESTATE.—A supply is to be provided to the East Herringthorpe estate at a cost of £9,000.

Rugby.—REORGANISATION OF L.V. SYSTEM.—The Town Council is to spend £100,000 on the reorganisation of its low-voltage electricity system.

St. Pancras.—METER ACCESSIBILITY.—Having considered a communication from the Electricity Committee regarding the difficulties experienced in obtaining access to meters in present-day houses and factories, the Housing Committee has agreed to call the attention of the housing architects to the matter.

Scotland. — ANOTHER HYDRO-ELECTRIC SCHEME.—The North of Scotland Hydro-Electric Board has published Distribution Scheme No. 8, which is one of the uneconomic schemes dependent upon a revenue-earning scheme of the Sloy and Tummel-Garry types. The distribution area, 690 miles, covers the whole of Skye with a population of about 10,400, to over 75 per cent. of whom a supply will be available. The intention is to generate at a hydro station near the mouth of the Barreraig River fed from the Storr Lochs and to connect it by submarine cable to the Lochalsh Distribution Scheme (No. 1). In some districts Diesel plant will be used until the hydro station is completed. It is hoped to start erection of the overhead transmission lines during the summer.

POWER FOR INDUSTRY.—The Board, answering inquiries regarding the cost of electricity to prospective large-power users in the Lochaber area, states that it should be possible to deliver electricity to a group of factories operating at a relatively high load factor at between 0·25d. and 0·3d. per kWh. These are average prices which take account of a certain amount of transmission cost in the interlinking of the various schemes, and delivering electricity at centres where industry could be conveniently located, but the ultimate cost depends to a large extent on the number of schemes over which transmission and other costs can be spread. Referring to sources of power the Board points out that absence of a scheme at Duntelchaig (Inverness water supply) will affect adversely the average price of electricity in the Highlands as a whole.

Southport.—STREET LIGHTING.—The Lighting Committee is to convert the lighting in North Promenade from gas to electricity and quotations are to be obtained from the gas and electrical engineers for improved lighting in various roads.

SUBSTATION.—The Electricity Committee is to erect a substation, etc., at a cost of £9,627 in connection with the change-over in the Birkdale area.

South Shields.—CHANGE-OVER.—The Town Council proposes to proceed with the change-over of Tyne Dock area to AC. The necessary switchgear is estimated to cost nearly £15,000.

Southwark. — WIRING INSTALLATIONS. — The Electricity Committee is seeking sanction to borrow £5,000 for rental wiring purposes.

Tynemouth.—STREET LIGHTING CHANGE-OVER.—The Town Council is to convert as many gas lamps as possible to electricity.

Wallasey.—BUSINESS TARIFF.—The Electricity Committee recommends that the terms of the new business tariff shall be amended to £9 per annum per kW for the first 10 kW of lighting demand registered and £7 per annum for each kW in excess of 10 kW, plus 0·66d. per kWh consumed.

TRANSPORT

Bradford.—TROLLEY-BUSES.—The Transport Department is to substitute trolley-buses for trams on the Bradford Moor route, at an estimated cost of £50,500, including overhead equipment and buses, the work to be carried out during the coming financial year.

Manchester.—TROLLEY-BUS ROUTE EXTENSION.—The Transport Committee proposes to extend the No. 30 trolley-bus route from Oxford Road to Moss Lane East.

South Shields.—TROLLEY-BUS EXTENSIONS.—Further extensions of the Corporation's trolley-bus system are planned at an estimated cost of £43,500, which includes the cost of ten new trolley-buses.

Faraday Lecture

AFTER being in abeyance during the war period the Faraday Lecture, arranged annually by the Institution of Electrical Engineers, is being revived on February 21st, for the benefit of the public generally rather than of members of the electrical profession. The lecture will be delivered by Dr. T. E. Allibone (Metropolitan-Vickers Electrical Co., Ltd.) who will talk about "Atoms, Electrons and Engineers," commencing at 7.30 p.m., in the Literary and Philosophical Lecture Theatre, Westgate Road, Newcastle-on-Tyne, and Alderman J. A. Clydesdale, Lord Mayor, will preside. Admission will be by ticket obtainable from Mr. J. McGeary, c/o A. Reyrolle & Co., Ltd., Hebburn-on-Tyne, Co. Durham.

Communication-Type Receivers

TENDENCIES in the design of radio receivers of the "communication type," not for specific purposes, are reviewed by Messrs. G. L. GRISDALE and R. B. ARMSTRONG (Marconi's Wireless Telegraph Co., Ltd.) in a paper read before the Radio Section of the Institution of Electrical Engineers.

The authors' object has been critically to survey the class of instrument they deal with, rather than to convey detailed design information. They start historically, proceed to mechanical considerations, and then at greater length comment on electrical features, dealing in some detail with the extent to which theoretical limits of signal/noise ratios are achieved in representative designs.

It seems reasonable to suppose that in future more attention will be devoted to better "proofing" against climatic extremes and variations, particularly for export, as well as greater unification of practice in this respect.

Reduction of the size of the individual component parts as well as the receiver as a whole is confidently expected. The authors speculate on whether the future receiver should be removable completely from service in the event of its failure for repair by specialists in some central organisation, instead of the prime desideratum being ability to carry out running repairs on the spot.

Finally it appears to be likely that better facilities for checking receiver performance, similar to built-in crystal calibrators, will be considered.

Power Cable Joints

GENERAL principles involved in the making of joints and sealing ends for power cables of the "pressure" type are discussed by DR. L. G. BRAZIER (British Insulated Callender's Cables, Ltd.) in a paper submitted to the Transmission Section of the Institution of Electrical Engineers.

The kind of cable concerned is fully impregnated by a "mass" process similar to that utilised for making solid cable; after installation, dry nitrogen gas is admitted to the interior of the cable in direct contact with the dielectric at a pressure of about 200 lb. per sq. in.

The paper commences with the properties of lapped paper dielectric and the mechanical features of joints. Design standards based on experimental results are set out and practical methods of construction described. An account is included of gas-controlling accessories as well as of means of locating leakage of gas with the aid of pressure-operated switches and electrically-operated valves installed in the cable joints with indicating pilot cores accommodated in two filler spaces within a three-core power cable.

The greater portion of the paper is devoted to the influence of voltage surges on joints and sealing ends. The author considers that the provision of sufficient insulation throughout adequately to withstand all surge contingencies would be too expensive. Instead the dielectric stress level should be made appropriate to normal AC service and excess voltage limited by draining off surge current through divertors connected between conductor and earth at one termination of the cable.

The surge divertors function by reason of the anomalous voltage/resistance characteristic of a special ceramic, or refractory, material formed by firing a mixture of silicon carbide and clay known as "Thyrite" (American, also British patent No. 292,100) and "Metrosil" (Metropolitan-Vickers) whose effective resistance is lowered by increase of the applied voltage.

Thus a three-phase installation of divertors suitable for limiting a surge to 385 kV before it reached the cable would cost about £1,000. The author's comparison shows that for three-phase 132-kV 0·4 sq. in. cable the use of surge divertors would be more economical for all lengths over 1,950 yards and that for a ten-mile feeder the saving would amount to about £8,000.

Vibration Effects

THE analysis of vibration effects is the subject of a paper by DR. A. J. KING (Metropolitan-Vickers Electrical Co., Ltd.) submitted to a joint meeting of the Installations and Measurements Sections of the Institution of Electrical Engineers.

The author first points out the several ways in which vibration manifests itself (as noise, flexing stress, rotational oscillation) and then describes available methods of measurement; their relative merits and limitations are indicated as are also the limits of methods of calibrating measuring apparatus.

The suppression of vibration is discussed from the point of view of what can be done at the source and what can be achieved by the use of resilient mountings. The second portion of the paper is concerned with the determination of design data (elasticity and damping capabilities) of materials suitable for reducing transmitted vibration. It includes a detailed description of a co-ordinate potentiometer (with moving coil drive) method of testing materials.

X-Ray Analysis Conference

The X-ray Analysis Group of the Institute of Physics is to hold its 1946 conference at the Royal Institution, London, from July 9th to 11th. It will be open to all without charge and it is hoped that several distinguished foreign scientists will participate in the proceedings. Further information will shortly be available from the honorary secretary, Mr. F. A. Bannister, Department of Mineralogy, British Museum (Natural History), Cromwell Road, S.W.7.

Forthcoming Events

Saturday, February 16th.—*Leeds.*—Electricity Offices, Whitehall Road, 2.30 p.m. I.E.E. North Midland Students' Section. "Atomic Physics," by R. L. Russell.

Monday, February 18th.—*London.*—Institution of Electrical Engineers, 7 p.m. I.E.E. London Students' Section. "The Measurement and Reduction of Noise," by Dr. A. J. King.

Institution of Mechanical Engineers, Storey's Gate, S.W.1. 6 p.m. Institute of Fuel. Joint meeting with the Institution of Municipal and County Engineers. "Individual and District Heating Systems: Cost, Technique and Planning," by D. V. H. Smith.

Birmingham.—Grand Hotel, 6 p.m. Birmingham Electric Club. "Electrical Equipment of Hospitals," by W. R. F. Brown.

Liverpool.—Royal Institution, Colquitt Street, 6 p.m. I.E.E. Mersey and North Wales Centre. "Factors Influencing the Design of Electric Lighting Installations for Building Interiors," by R. O. Ackerley.

Tuesday, February 19th.—*London.*—Lighting Service Bureau, Savoy Hill, 6.15 p.m. Association of Supervising Electrical Engineers. "Underground and Overhead Distribution up to 660-V," by L. R. Perkins.

Stockport.—Mersey Hotel, 7.30 p.m. A.S.E.E. (Manchester Branch). "Power Factor," by W. G. D. Gregg.

Luton.—Town Hall, 7.30 p.m. Luton Electrical Society. "Mercury Arc Rectifiers," by A. E. Nicol.

Manchester.—Engineers' Club, Albert Square, 6 p.m. I.E.E. North-Western Centre. "Street Lighting," by E. C. Lennox.

Wednesday, February 20th.—*London.*—Institution of Electrical Engineers, 5.30 p.m. I.E.E. Radio Section. "New Methods for Locating Cable Faults, particularly on High Frequency Cables," by F. F. Roberts.

John Adam Street, Adelphi, W.C.2, 1.45 p.m. Royal Society of Arts. "Radar," by J. T. Randall.

Sheffield.—Royal Victoria Hotel, 2.30 p.m. I.E.E. North-Western Centre. Annual joint meeting with the North Midland Centre and Sheffield Sub-Centre." "The Operation of Large Turbo-Alternators to Reduce Rotor-Winding Deformation," by R. H. Coates and B. C. Pyle.

Thursday, February 21st.—*London.*—Westminster Abbey, noon. Joint memorial service to the members of the Institutions of Civil, Electrical and Mechanical Engineers who lost their lives in the war.

Manchester.—Engineers' Club, Albert Square, 6.30 p.m. I.E.E. North-Western Centre (Students' Section). "Industrial Electric Drives," by F. W. Cox.

Newcastle-on-Tyne.—Lit. & Phil. Lecture Theatre, Westgate Road, 7,30 p.m. I.E.E. North-Eastern Centre. Faraday lecture. "Atoms, Electrons and Engineers," by Dr. T. E. Allibone.

Friday, February 22nd.—*London.*—Institution of Electrical Engineers, 5.30 p.m. I.E.E. Measurements Section. "The Characteristics and Errors of Capacitors used for Measurement Purposes," by C. G. Garton.

Monday, February 25th.—*Bristol.*—Grand Hotel, 6 p.m. I.E.E. Western Centre (Installations Group). Informal dinner meeting. Short opening talks, "Is an Electrical Proving House Needed?" by R. H. Cobbold, and "Electrical Problems associated with Paper Making Machinery," by A. C. Warman.

Newcastle-on-Tyne.—Neville Hall, Westgate Road, 6.15 p.m. I.E.E. North-Eastern Centre. "Operational Control of Electricity Supply Systems," by W. Kidd and E. M. S. McWhirter.

Tuesday, February 26th.—*London.*—Institution of Electrical Engineers, 5.30 p.m. I.E.E. Radio Section. Discussion on "Comparison of Electrostatic and Magnetic Deflection in Cathode-Ray Tubes," to be opened by V. A. Stanley and E. W. Bull.

School of Tropical Medicine, Gower Street, 7 p.m. Society of Instrument Technology. "The Effect of Design of Boiler Auxiliaries on the Choice and Performance of Automatic Control," by J. E. O'Breen.

Glasgow.—Royal Technical College, 6.15 p.m. I.E.E. Scottish Centre. "Excess Current Protection by Overcurrent Relays on Medium Voltage Circuits," by A. G. Shreeve and P. J. Shipton, and "Excess Current Protection," by H.R.C. Fuses on Medium Voltage Circuits," by R. T. Lythall.

Manchester.—Midland Hotel. North-Western and North Wales E.D.A. Seventeenth annual luncheon.

Telephone Service Arrears

ON February 4th, the Assistant Postmaster-General stated in the House of Commons that the total number of applicants on the waiting list for telephone installations was just under 300,000. In spite of a large number of new applications the rate of growth of the waiting list was slackening off. The delay in connecting up subscribers was due to shortgage of labour to undertake the work and of spare equipment.

The staff employed on connecting subscribers had already been increased and the rate at which telephones were being provided was now about 25 per cent. higher than in the peak pre-war year. Arrangements had been made for Class B release of 2,000 skilled Post Office engineers from the Forces, and when these were available the rate of installing telephones would be still further accelerated. A large programme of work was being undertaken to provide additional cables and to increase exchange capacity. At the present moment, ducts for new underground cables were being provided in 74 towns, and 140 additional contracts were ready to be placed as soon as labour was available. During the current financial year, £1,600,000 was being provided for new ducts and cables for subscribers' lines, and during the following year about £4,000,000.

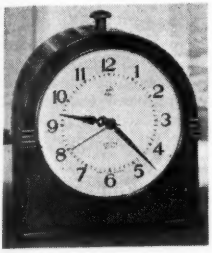
To increase exchange capacity, contracts had been placed for additional equipment at 252 automatic exchanges and for 65 entirely new exchanges. The total value of these contracts amounted to £2,700,000. A further £500,000 was being spent on providing additional equipment at manually operated exchanges.

RECENT INTRODUCTIONS

Notes on New Electrical and Allied Products

Alarm Clock

MOULDED cases with ivory or walnut finishes enclose the "Sectric Autolarm" mains-driven clock now being made by SMITH'S ENGLISH CLOCKS, LTD., Cricklewood Works, London, N.W.2. A centre seconds hand is fitted as an indicator, since the clock is self-starting. Depression of



Walnut finished mains alarm clock

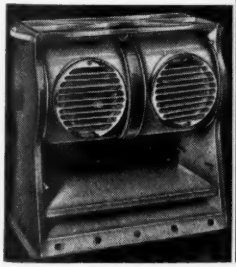
a knob at the top will stop the alarm, which then resets itself automatically to sound again in 24 hours. Depression and rotation of the knob will lock-out the alarm, the buzz tone of which can be adjusted with the aid of a screwdriver after disconnection from the mains. The clock is 3½ in. deep by 5 in. high and wide.

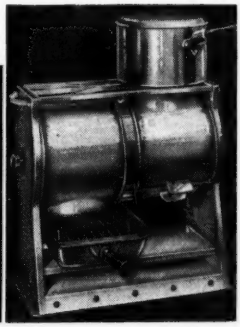
Combination Griller

An unusually designed appliance of the breakfast cooker type is announced with the trade name of "Whirl" by C. C. ELECTRICAL, 319, Baldwin's Lane, Hall Green, Birmingham, 28.

The heating elements, each loaded to 1,000 W and individually switched, are fitted into horizontal drums which are separately rotatable in either direction to allow the heat to be directed downward for grilling, midway for use as a fire and upward for boiling. The elements are of standard design, easily replaceable; they are suspended in a manner that should avoid sag and are protected by fluted guards which minimise obscuration. A junction box is fitted to permit renewal of flexible connections without interfering with interior components, which are wired on the bus-bar system, while the bottom supporting plate serves as a ventilator and is spaced to act as a heat insulator between the appliance and the table on which it stands. The pressed steel body is 1 ft. 4 in. long, 1 ft. 3 in. high and 8 in. wide, weighing 15 lb. It is finished in two colours: black and gold or silver, or cream and brown.

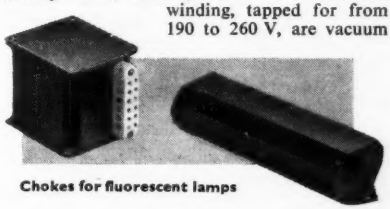
Combination "Whirl" drum cooker-fire





Lamp Chokes

Chokes for use in combination with fluorescent lamps of the 80-W 5 ft. tube size are now being made by the WODEN TRANSFORMER CO., LTD., Moxley Road, Bilston, Staffs. The core and winding, tapped for from 190 to 260 V, are vacuum



Chokes for fluorescent lamps

impregnated and enclosed in a stove enamelled steel can, which is filled with compound to prevent the ingress of moisture. The special terminal block is made of porcelain. In addition to the rectangular model another is made of long flat shape, suitable for attachment to inverted shallow trough reflectors.

Supply for Cinema Projectors

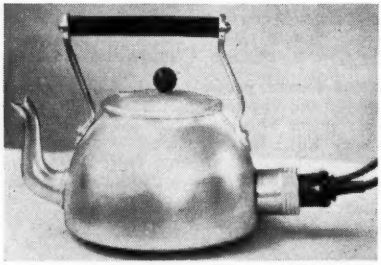
Adaptability to operating needs is a feature of the "Nevelector," made by the NEVELIN ELECTRIC CO., LTD., Purley Way, Croydon, Surrey, for energising DC projectors in cinemas. Twelve output characteristics are obtainable, simple rotary switching enabling the operator to change over from low to high intensity projection, or to the spot lamp; to change DC lamps at will; to "burn in" with small current for forming good craters when lamp carbons are renewed; and to step up the current on foggy days, or for dense film prints.

A glass-bulb mercury rectifier with fan, choke, transformer, smoothing and relay gear are contained in a sheet steel cubicle. On the sloping front panel, floodlighted from above, are a moving coil ammeter and a voltmeter with two switches below for fine and coarse control. The cubicle is 19 in. wide by

16 in. deep and 3 ft. 9 in. high, weighing 250 lb. and occupying little floor space. It can be installed without skilled assistance, needing simply to be connected to AC mains through a double pole ironclad switch and through an isolator to the arc projector beside which the cubicle stands. The overall conversion efficiency is claimed to be unusually high for cinema arcs.

Aluminium Kettle

A four-pint kettle is being made under the trade name of "Cepco" by ERINEX, LTD., of Flore, Northampton. It is made of spun



Hand-made prototype aluminium kettle

aluminium, polished, having a handle with a forward rake and (if required) feet can be provided. The immersion element is loaded to 1,250 W at normal voltages.

Protection for Welders

Dual-purpose screens and helmets for arc welders offered by MUREX WELDING PROCESSES, LTD., Waltham Cross, Herts, are made of bakelite laminated fabric sheet.

A feature of the screen is its patented holder which secures permanently in position a protective cover glass (plain) forming the chipping screen. In addition a coloured glass can be moved in and out of position by the mere touch of a lever by the thumb of the hand holding the screen. Thus the operator can sight his work up to the last moment before striking the arc. The depth of the screen protects the user against side flashes.

The helmet is fitted with a somewhat similar glass holder, but actuated by an external knurled knob instead of a lever. An adjustable head-band enables the helmet to be swung above the wearer's head and retained in that position, while a slight head movement will cause the helmet to fall forward again into the protective position.

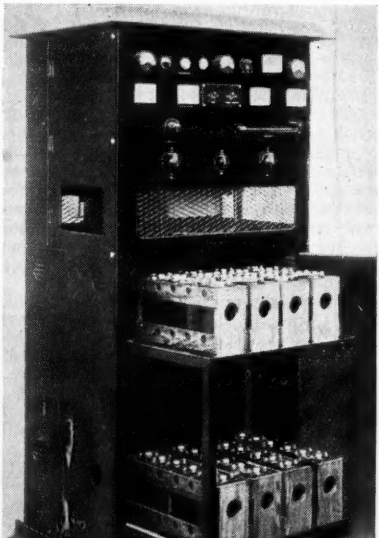
Spot Welder

A spot welding machine has been named "Autoforge" by MERITUS (BARNET), LTD., Wood Street, Barnet, Herts, because it is actuated by a foot pedal which is interlocked so that, once depression has initiated the welding cycle, the forging pressure will be maintained automatically until released by the electrical timing gear. During the forging period it is not even necessary for the machinist to keep his foot on the pedal, which is gently released when the weld has been completed. A regulator enables the forging time to be varied, so that the electrode tips may be kept closed under mechanical pressure to permit the solidifying joint to consolidate.

The contactor gear and control panel are built into the base of the machine and the compartment door can be locked. The electrode arms are telescopic, from 24 to 8 inches, sliding into the body of the machine. A pressure indicator is fitted and a flow indicator for the circulating water that cools the electrodes. With a single-phase input at 400 V the nominal rating is 20 kVA and a bracket lamp (24 W at 12 V) with adjustable arm furnishes local light at the electrode tips.

Emergency Lighting Equipment

To facilitate the maintenance of the batteries incorporated in the apparatus supplied for emergency lighting, switch tripping, etc., PARTRIDGE, WILSON & CO., LTD., are now, if desired, arranging the batteries on two trays fixed to the withdrawable trolley. The batteries can thus be readily and speedily removed for inspection and topping up.



Withdrawable battery racks

FINANCIAL SECTION

Company News. Stock Exchange Activities.

Reports and Dividends

The Yorkshire Electric Power Co. states that the net profit for 1945 amounted to £778,441, compared with £772,307 for 1944. The final dividend on the ordinary stock, as already announced, is 6 per cent. (against 5 per cent.), raising the total distribution for the year from 8 to 9 per cent.

The directors also recommend the transfer of £375,000 (against £350,000) to the depreciation and reserve fund, £50,000 (£25,000) to the war damage contributions reserve fund and £150,000 to taxation reserve fund. Last year there were allocations of £75,000 to plant renewals reserve, £50,000 to deferred repairs reserve, £75,000 to contingencies reserve and £5,000 to staff benevolent fund.

In his speech, circulated in advance of next Monday's annual meeting at Leeds, the chairman (Sir R. Geoffrey Ellis, Bt.), refers to the advent of a Socialist Government and its possible effects upon the electricity supply industry. They claim to be one of the undertakings referred to in the McGowan Report as progressive and enterprising. The threatened Government action is political and holds nothing or the consumer but a long period of difficulty. If their business were taken over they would demand fair compensation for the surrender of their unlimited franchise and for capital expended but not yet productive.

Their new Mexborough station is in full operation but there have been delays through Departmental muddles in the extensions at Ferrybridge and Thornhill for which the company is paying dearly. They find, after giving due weight to their liabilities, that the contingencies reserve can now be released and made available for distribution; this has enabled the dividend to be raised and they are of the opinion that the higher dividend can be maintained if the Government concentrates upon the changeover and recovery of industry, leaving political experiments for a firmer future.

Dealing with the accounts, Sir Geoffrey Ellis refers to the grave anxiety caused by the continued increase in the cost of coal and the need for a better spirit in the industry. They hope that the present trend towards compensation for lost munitions load by new demands will continue.

Philco Radio & Television Corporation of Great Britain, Ltd.—The directors of the company and the Philco Corporation of Philadelphia have entered into a new agreement whereby the British company is now free to export radio and television receivers under the trade mark "Airmec" or any other name except Philco. As before, these products will be sold in the British Isles under the name Philco. The directors consider that these alterations are in the shareholders' interests, and in order to achieve them certain corporate changes are necessary. The company is to become a holding company and the name changed to Radio and Television Trust. Overseas sales will be conducted by a separate wholly owned subsidiary, Airmec International Sales, and not under the Philco name, sales in the British Isles of Philco branded products will be conducted by a new subsidiary, the Philco Radio and Television Corporation of Great Britain, and manufacture of radio and electronic products will be conducted by a wholly owned subsidiary, Airmec, Ltd.

Broom & Wade, Ltd.—At the annual meeting the chairman (Mr. H. S. Broom) said that the company's output had been very severely handicapped by the withdrawal of young men for the Services just as they were completing their training. As regards the engineering industry as a whole, he thought that the withdrawal of these young men would greatly reduce the national output. Dealing with the company's plans for export trade, he announced that subsidiary companies were being formed in South Africa and Australia to develop these markets.

Lancashire Dynamo & Crypto, Ltd., has received permission from the Capital Issues Committee to issue 50,340 new ordinary £1 shares at 90s. per share to existing holders in the ratio of one for every eight held. On the basis of the market price of existing shares the offer involves a bonus element.

The Electrical & Industrial Investment Co., Ltd., reports a gross revenue, plus interest, etc., for 1945 of £55,344 (against £55,222 for 1944) and a net profit of £22,112 (£21,882). After payment of the preference and preferred dividends and 12 per cent. (same) on the deferred shares, £9,247 (£9,121) goes to undivided profits, making £99,566.

The London Electric Supply Corporation, Ltd., has declared a dividend on the ordinary shares, payable March 18th, of 3 per cent., and a further 3 per cent. drawn from reserve, making 6 per cent. for 1945 (for the previous year the dividend paid was 4 per cent. plus 2 per cent. from reserve).

Mather & Platt, Ltd., have declared a final ordinary dividend of 6 per cent., again making 10 per cent. for the year. The net profit, after taxation, was £184,154, against £172,294 for 1944.

New Companies

E. Morrell & Co., Ltd.—Private company. Registered February 4th. Capital, £2,000. Objects: To acquire the business of manufacturers of domestic electrical appliances carried on by Christopher C. A. Morrell and George Evans, at "Eastdene," Whitecross, Hallatrow, Somerset, as "Morrell & Co." Directors: G. Evans, "Eastdene," Whitecross, Hallatrow, Somerset, and C. C. A. Morrell, "Tresco," Huntspill, Highbridge, Somerset. Registered office: "Eastdene," Whitecross, Hallatrow.

C. H. Turner & Co. (Grimsby), Ltd.—Private company. Registered January 30th. Capital, £2,000. Objects: To carry on the business of manufacturers of, dealers in, and repairers and hirers of, electrical and mechanical apparatus, accessories and components, and in particular of radio sets and valves, television sets, etc.

Directors: C. R. Turner, 13, Annesley Street, Grimsby and Grace Draper, 6, Phyllis Avenue, Grimsby. Registered office: 28, Signhills Avenue, Cleethorpes, Lincs.

L. L. K., Ltd.—Private company. Registered January 31st. Capital, £11,000. Objects: To carry on the business of electrical engineers and contractors, manufacturers of electronic, radio, public address and television apparatus, electric signs, phonographs, etc. Directors: J. McEwan King, c/o Kealler, 106, West Princes Street, Glasgow, C.3 and J. Love, Lyndhurst, Julian Road, Ludlow, Salop. Registered office: 27, Wind Hill, Bishops Stortford.

Gourlay Electrical, Ltd.—Private company. Registered January 31st. Capital, £4,000. Objects: To carry on the business of electrical engineers and general electrical installation contractors, etc. Directors: J. Gourlay, 28, Riley Crescent, Penn Fields, Wolverhampton (director of De Renzi Holmes & Co., Ltd.), and A. A. Johnstone, The Bungalow, Woodland Road Whitby, Wirral. Registered office: Post Office Chambers, Ellesmere Port, Wirral.

J. S. Denholm (Dumbarton), Ltd.—Private company. Registered in Edinburgh January 25th. Capital, £1,000. Objects: To carry on the business of electrical and mechanical engineers, suppliers of electricity for light, heat, motive power, etc. Directors: J. S. Denholm, 31, Dinmont Road, Glasgow, S.1 and J. R. Fleming, 39, Deanston Drive, Glasgow, S.1. Registered office: 55, Church Street, Dumbarton.

D. A. G. Lamp Co., Ltd.—Private company. Registered January 31st. Capital, £100. Objects: To carry on the business of electrical engineers and general electrical installation contractors, lighting specialists and contractors, heating and ventilating engineers, etc. Directors: D. Corner and Pamela R. Corner, both of 3, Birchwood Mount, Moortown, Leeds. Registered office: 6 & 7, Cross Fountain Street, Leeds, 1.

R. Henson, Ltd.—Private company. Registered February 5th. Capital, £500. Objects: To carry on the business of manufacturers of, and dealers in, artificial lighting apparatus, electrical, gas and oil lamps, quartz lamps, reflectors, searchlights, bells, fires, stoves, etc. Directors: R. I. Henson and Jeannette Henson, both of 129, Mayfield Avenue, North Finchley, N.12. Registered office: 62, Brook Street, W.1.

Neoflex, Ltd.—Private company. Registered February 5th. Capital, £500. Objects: To carry on the business of electrical, mechanical and general engineers, metal founders, tool and pattern makers, manufacturers of, and dealers in, cables, plastics and rubber, etc. Director: Peter S. de Gray, Colne Way, Watford.

F. H. Dowdall (Electrical Engineers), Ltd.—Private company. Registered January 31st. Capital, £250. Objects: To carry on the business of electrical engineers and contractors, etc. Directors: F. H. Dowdall, 12, Brondesbury Road, N.W.6, and F. Peasey, 86, Longley Road, Harrow Weald, Mdx.

D. & F. Electrical Stores, Ltd.—Private company. Registered February 1st. Capital, £1,200. Objects: To carry on the business of manufacturers of, wholesale and retail dealers in, and agents for manufacturers of, and repairers and hirers of, domestic, household and general electrical and mechanical equipment, apparatus and appliances, and in particular radio sets and valves, television sets and electrical and mechanical sound and visual reproducing machines and accessories, etc. Directors: W. E. Fill and E. Davies, both of 19, Butcher Row, Beverley, E. Yorks. Registered office: 19, Butcher Row, Beverley.

Increases of Capital

Teddington Controls, Ltd.—The nominal capital has been increased by the addition of £40,000 in 800,000 ordinary shares of 1s. each beyond the registered capital of £10,000.

(At July 6th, 1945, the principal shareholder was the British Thermostat Co., Ltd., holding 21,940 shares of 1s. each out of 22,000 issued.)

Specialised Radio Service Co., Ltd.—The nominal capital has been increased by the addition of £3,000 in £1 shares beyond the registered capital of £2,000.

Mortgages and Charges

William White & Co. (London), Ltd.—Debenture, charged on 13, Cursitor Street and property at Arch Street, Newington, London, and the company's undertaking and other property, present and future, including uncalled capital, dated January 15th, 1946, to secure all moneys due or to become due from the company to Lloyds Bank, Ltd.

Bev-Gree, Ltd.—Mortgage on 7, Jamaica Street and 6, Lower Gay Street, Bristol, with fixtures, dated January 16th, 1946, to secure all moneys due or to become due from the company to Midland Bank, Ltd.

Mec-Electric, Ltd.—Mortgage on 12, Cheriton High Street, Folkestone, dated January 10th, 1946, to secure all moneys due or to become due from the company to Midland Bank, Ltd.

L. Bunce (Electrical), Ltd.—Mortgage on 87 and 88, King Street, Dudley, Worcs., with fixtures, dated January 21st, 1946, to secure all moneys due or to become due from the company to National Provincial Bank, Ltd.

Liquidations

Berec Battery Co., Ltd.—Winding up voluntarily. Liquidator, Mr. W. S. Giles, Hercules Place, Holloway, N.7, appointed January 29th, 1946.

Welding Equipment, Ltd.—Winding up voluntarily. Liquidator, Mr. H. Lomax, 83, Bridge Street, Manchester, 3, appointed January 29th, 1946. All creditors of the company have been paid in full.

Resistance Microphones, Ltd.—Meetings of members and creditors to be held on March 9th, at 100, Old Broad Street, London, E.C.2, to hear an account of the winding-up from the liquidator, Mr. A. Southgate.

Bankruptcies

R. J. M. Holmes (deceased), 17, Buston Terrace, Newcastle-upon-Tyne, electrical engineer.—Trustee, Mr. A. K. Ferguson, Gibb Chambers, 54, Westgate Road, Newcastle-upon-Tyne, Official Receiver, released February 5th.

STOCKS AND SHARES

PRICES of Stock Exchange securities are well maintained, more especially those connected with the gilt-edged departments, but the volume of business throughout the markets has dwindled, which, in view of the current political uncertainties, is not a matter for surprise. The amount of money available for employment in stocks and shares is, however, constantly accumulating. This in itself makes an adequate reason for the strength of prices of purely investment stocks and shares.

The Southern Railway and the London Passenger Transport Board were expected to announce the dividends on the junior stocks for 1945 on Thursday. The declarations were awaited with more interest by reason of the surprise increase in the London, Midland & Scottish dividend, which was 4 per cent. against 2½ per cent. in the previous twelve months. The effect upon the market was startling, and home railway pre-ordinary stocks, as well as those more immediately affected, went up in sympathy. Southern 5 per cent. preferred hardened to 75.

Fluctuations in Prices

Amongst other rises which have taken place in the ordinary shares of home electricity supply companies, North Easterns are noticeably better at 32s. 6d., Northamptons at 47s. 6d., Scottish Power at 36s. 6d., and British Power at 29s. Electrical Distribution of Yorkshire at 42s. and Midland Counties at 39s. are also harder. County of London and Metropolitan each rose to 43s. In the overseas group, Palestine Electric "A" recovered to 37s. 6d. and a further rise of 2s. 6d. carried Victoria Falls ordinary shares to 5¾. Tokyo Electrics at 52½ show a loss of 3 points.

Ericssons have been a good market, with a rise of 2s. 6d. to 53s. 9d. International Combustion at 8¾ are 7s. 6d. higher. Westinghouse Brake, the figures of whose report are regarded as being satisfactory, at 74s. 6d. are ex the dividend. A sharp rise took Thomas Tilling shares to 52s. 6d.: the chairman at last week's meeting dealt with nationalisation and unification, declaring that the latter is absolutely essential. The Cable group is steady, with Cable preference 2 points higher at 113. Atlas Electrics fell back to 10s. Ward & Goldstone at 33s. 6d. are 6d. up.

Yorkshire Electric Dividend

Yorkshire Electric Power afforded satisfaction to its shareholders and the market by raising the final dividend from 5 to 6 per cent. This made 9 per cent. for the year to December 31st, 1945. Throughout the war, and for many years previously, the annual distribution had been a regular 8 per cent. After rising 2s. on the announcement, the shares stand at 44s., to yield £4 1s. 9d. per cent. on the higher dividend rate. The areas served by the company include the Yorkshire coalfields and the chief manufacturing centres of the West Riding. The dividend announcement exercised a hardening effect upon other shares in the same market.

Lancashire Electric

Thanks to the good result of the issue of Lancashire Electric 3¼ per cent. preference shares at 20s., the 1,000,000 shares having been over-subscribed in less than a couple of hours from the opening of the lists, the market for Home electricity shares has carried still further the better tendency to which attention has been drawn of recent weeks. The shares were offered at a fairly high price and a 3¼ per cent. yield on however high-class an industrial security, is not everybody's money, yet the shares were snapped up with an ease which suggests that the issue could have been twice as big with equal success.

Lancashire Dynamo Issue

Lancashire Dynamo hold their previous rise to 5⅛. The Capital Issues Committee has given the company permission to offer 50,340 new ordinary shares at 90s. per share, in the ratio of one new for every eight old. Taking 5¾ as the basis of Lancashire Dynamo shares, the rights are worth about 2s. 10½d. per old share.

Johnson & Phillips

Lurking uncertainty still exists in regard to the proposed loan from America, over which there has been so much controversy. Until the matter is settled, neither finance nor industry will be able to feel sure of its ground. The prices of ordinary shares in home industrial companies hold their previous levels; in some cases, show a disposition to improve upon them. Johnson & Phillips, in going ahead to develop the business of British National Electrics which they have just acquired—for the manufacture of electric water cookers, tubular heaters, etc.—will be assisted by the additional works that the acquisition gives them. The price of the shares is steady at 80s. 6d.

Radio Shares

The full accounts of E. K. Cole, Ltd., and a review of the conditions in the annual report, have been the chief influence this week on radio and kindred shares. Active dealing in the popular issues has continued, leaving prices rather lower on balance. Notice had already been given to the decline in E. K. Cole profits. The full figures show that the 20 per cent. dividend is again comfortably covered by earnings. The report enlarges on the difficulties of the turn-round from Government work to the recovery of normal business. E. K. Cole 5s. shares remain about 33s. 9d., at which the yield of under 3 per cent. still witnesses confidence in the company's prospects, once the transition stage has been negotiated. E.M.I. have come back to 34s. Cossors at 44s. are a little easier. A fair amount of interest is being shown in Radio Rentals at around 30s.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (1s. each) may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C.2.

AKT. GES. BROWN, Boveri & Cie.—" Heat exchanger for heating gases and vapours to a high temperature." 9003/43. June 23rd, 1942. (574810.)

Alpha Accessories, Ltd.—" Primary electrical batteries." 20091/43. March 4th, 1943. (574951.)

T. Bolton & Sons, Ltd., W. E. Alkins and W. F. Slater.—" Electric conductors." 16112. August 24th, 1944. (574926.)

British Insulated Cables, Ltd., and E. W. Mills.—" Plastic materials particularly applicable for the covering of electric conductors." 220. January 5th, 1943. (574804.)

British Mechanical Productions, Ltd., F. C. Fuke and L. W. Shorey.—" Electrical fuses." 17937. October 29th, 1943. (574822.)

British Thomson-Houston Co., Ltd.—" Magnetic induction accelerators." 9709/43. June 17th, 1942. (574812.) " Dynamo-electric machine." 16416/42. November 27th, 1941. (574880.) " Ignition systems for internal-combustion engines." 15365/42. October 31st, 1941. (574940.)

British Thomson-Houston Co., Ltd. (General Electric Co.).—" Wave impulse generators." 8528. May 27th, 1943. (574844.)

British Thomson-Houston Co., Ltd., and T. H. Kinman.—" Radio signalling apparatus." 1856. January 30th, 1940. (574932.)

British Thomson-Houston Co., Ltd., T. F. Robinson, R. T. Coe and D. F. Welch.—" Ignition systems for internal-combustion engines." 6719. May 18th, 1942. (574836.)

British Thomson-Houston Co., Ltd., W. J. Scott, D. F. Welch and A. Grieve.—" Hermetically sealed spark gaps." 10241. August 12th, 1941. (574833.)

Cinema-Television, Ltd., and S. S. West.—" Apparatus for detecting and/or locating by electrical means masses of electrically conducting or magnetic material." Cognate applications 8086/43 and 14884/43. May 21st, 1943. (574808.)

Eaton Manufacturing Co.—" Thermo-electric generators." 10306/43. April 1st, 1943. (574816.)

Frigidaire, Ltd., W. O. Kennington, E. Whalley and A. J. Sinclair.—" Catalytic heaters." 14289. October 12th, 1942. (574871.)

General Electric Co., Ltd., and A. S. Gladwin.—" Variable controlled electric oscillators." 3374. March 1st, 1943. (574840.)

General Electric Co., Ltd., S. H. Dale and W. G. Thompson.—" Protective arrangements for electric supply systems." 6338. May 16th, 1941. (574801.)

W. W. Gleave and Imperial Chemical Industries, Ltd.—" Electrodes for use in electrolytic cells." 14182. October 9th, 1942. (574870.)

H. H. Goldstaub.—" Resistors." 7879/43. May 18th, 1944. (574906.)

Hazeltine Corporation. — " Harmonic-frequency generator." 11024/42. September 20th, 1941. (574838.) " Electrical indicating system." 277/43. December 31st, 1941. (574941.) " Unitary balanced inductor system." 21683/43. December 31st, 1942. (574955.)

Jack & Heintz, Inc.—" Speed governor operated electric switches." 21491/43. November 2nd, 1942. (574893.)

A. N. Jackson.—" Electric heaters for liquids." 12067. July 24th, 1943. (574909.)

J. D. McGee.—" Electron discharge devices such as light transformers." 16274. November 17th, 1942. (574878.)

M-O Valve Co., Ltd., N. L. Harris and J. W. Ryde.—" Electrical resonators." 7236. April 22nd, 1940. (574934.)

M-O Valve Co., Ltd. N. L. Harris and R. W. Sloane.—" Electric discharge devices adapted to operate at high frequencies." 9689. June 3rd, 1940. (574935.)

Nalder Bros. & Thompson, Ltd., and C. L. Lipman.—" Damping apparatus for electrical instruments, meters and relays." 21534. December 23rd, 1943. (574894.)

C. J. Robinson.—" Electric induction heaters." 4795/43. March 19th, 1942. (574805.)

Siemens Electric Lamps & Supplies, Ltd., and J. N. Aldington.—" Incandescent electric lamps." 2593. February 11th, 1944. (574827.)

Standard Telephones & Cables, Ltd.—" Preventing distortion in amplifiers and modulators." 19377/43. November 25th, 1942. (574823.) " Vacuum tube voltmeter circuits." 7408/44. April 24th, 1943. (574830.) " High-frequency electrical translating devices." 10006/42. March 25th, 1941. (574837.) " High-frequency electric induction heating." 3057-8/44. February 25th, 1943. (574914-5.) " Electrically insulating plates provided with a system of electrical connections." 18107/43. November 5th, 1942. (574946.)

Standard Telephones & Cables, Ltd., C. W. Earp and C. E. Strong.—" Radio systems for lading aeroplanes." 5912. April 2nd, 1940. (574933.)

A. H. Stevens (Eastman Machine Co.).—" Follow-up electric switch mechanism." 1057. January 19th, 1944. (574959.)

A. Sulzberger.—" Electric calculating device." 4972. March 26th, 1943. (574841.)

Sulzer Freres Soc. Anon. " Gas turbine plants." 10595/44. June 8th, 1943. (574921.)

A. A. Thornton (Warner Electric Brake Manufacturing Co.).—" Electro-magnetic friction devices." 10098. June 22nd, 1943. (574907.)

Western Electric Co., Inc.—" Electron discharge apparatus for producing high-frequency electrical oscillations." 6670/43. May 1st, 1942. (574943.)

Westinghouse Electric International Co.—" Apparatus for discharging a relatively non-volatile substance or relatively non-volatile substances to the atmosphere." 14359/43. August 28th, 1942. (574820.)

E. L. C. White, M. G. Harker and J. P. W. Houchin.—" Electrical control systems." 9384. June 10th, 1945. (574811.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

Contracts Open

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Ashton-under-Lyne.—February 25th. Sewage Purification Committee. Electrical wiring, lighting, heating and power at the Corporation sewage works. (February 1st.)

Bedford.—February 28th. Electricity Department. H.v. and l.v. cables for twelve months. (February 8th.)

Belfast.—February 22nd. Electricity Department. Electrical stores and materials. (February 1st.)

Brighton.—March 4th. Electricity Department. Eight 500-kVA three-phase transformers. (See this issue.)

East Ham.—March 2nd. Electricity Department. Electric cookers and storage tanks for twelve months. (See this issue.)

Erith.—February 28th. Electricity Department. Electrical materials for twelve months. (February 1st.)

Hastings.—February 19th. Electricity Department. Cable laying. (February 1st.)

Hull.—February 25th. Electricity Department. Five electric battery vehicles. (See this issue.)

Littleborough.—February 28th. Electricity Department. Underground cables and sub-station equipment. (February 8th.)

Manchester.—March 4th. Electricity Department. Domestic electric cookers, for twelve months. (See this issue.)

Radcliffe.—March 6th. Electricity Department. One 6,000-kVA transformer. (See this issue.)

Sale.—Corporation Supply and delivery of cable and eight 500-kVA transformers. (February 8th.)

Tredegar.—March 9th. Urban District Council. Two-panel 11-kV metal-clad switchboard. (See this issue.)

Worcester.—February 26th. Electricity Department. Cables, conductors, transformers, meters and joint boxes for twelve months. (February 1st.)

Orders Placed

Aberdeen.—County Council Finance Committee. Electrical work at sixty houses (£1,312).—H. Russell.

Barrow-in-Furness. — Electricity Committee. Accepted. Two transformers (£894).—English Electric Co.

Blackburn.—Town Council. Accepted. Grab for the electricity station (£388).—Priestman Bros.

Blackpool.—Electricity Committee. Accepted. Three batteries and chargers and control switchboard.—Chloride Electrical Storage Co.

Housing Committee. Accepted. Electrical installations in 14 houses in Grange Road (£303).—G. Morrison.

Newcastle-on-Tyne.—City Council. Accepted. Switchgear extensions (£788).—A. Reyrolle & Co.

Southport.—Electricity Committee. Accepted. Switchgear for two years.—Ferguson Pailin.

Health Committee. Accepted. Refrigerator cabinet (£120).—Electric House (Denton).

Watch Committee. Accepted. Traffic signals, Sussex Road (£451).—Automatic Telephone & Electric Co.

Housing Committee. Accepted. Electrical work at 30 houses in Russell Road (£962).—Woodfall & Rimmer.

South Shields.—Corporation. Accepted. Electrical installations in 440 new houses.—J. Calvert.

Wallasey.—Electricity Committee. Accepted. 1,500 ordinary meters (£2,825).—Sangamo Weston; 280 prepayment meters (£1,031).—Landis & Gyr. Two summation meters (£250).—Ferranti.

Contracts in Prospect

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Alnwick.—Houses (250), various sites for the R.D.C.; G. Reavell, architect, Lloyds Bank Chambers.

Ashbourne.—Houses (50), for U.D.C.; Houfton & Kington, architects, Market Place, Chesterfield.

Ashton-in-Makerfield.—Church schools for Parish Church Council (£12,000); Rev. W. R. H. Hall, The Rectory.

Audenshaw.—Permanent houses (40), Corporation Road; Halliday & Agate, architects, 14, John Dalton Street, Manchester 2.

Barrow-in-Furness. — Extensions, Grammar School for Boys; borough engineer.

Beaumaris.—Houses (70), for Town Council; S. Colwyn Foulkes, architect, Central Chambers, Colwyn Bay.

Birkenhead.—Houses (54), Bedford estate (£69,750); Peak Construction Co., Ltd.

Bishop's Stortford.—Permanent houses (32), Havers Lane site; U.D.C. surveyor, Council Offices.

Bournemouth.—Community centre, Kinson; borough engineer.

Caithness.—Houses (290), including electrical work; J. M. Henderson, county architect, Wick.

Cardiff.—Factory, site at Pengam (wholly electric); C. H. Elkes & Sons, Ltd., Dove Valley Bakeries, Leek, Staffs.

Crematorium (£83,000) and extensions to City Hall (£60,000); city architect.

Works extensions, Gabalfa; British Fram Construction Co., Ltd.

Cheltenham.—Factory, Lynmouth Farm estate (£9,975); Montal Watch Fittings, Ltd.

Cheshire.—Extensions, Cranage Hall colony (£49,220); county architect.

Coventry.—Rebuilding hospital buildings for Coventry and Warwickshire Hospital Board of Governors (£100,000); W. S. Hattrell and Partner, architects, 1, Queen's Road.

Extensions, technical college (£6,280); city engineer.

Dudley.—Houses (160), Yew Tree estate; borough engineer.

Durham.—Houses (101) for the City Council; J. W. White, Ltd., builders, High Barnes, Sunderland.

Eston.—Houses (900), Lowfields estate; C. M. Yuill, Ltd., West Hartlepool.

Felling-on-Tyne (Co. Durham).—Mineral water factory for A. Towers & Co., Ltd.; E. M. Lawson, Barras House, Barras Bridge.

Fifeshire.—School at Leven for County Council; county architect, Cupar, Fife.

Houses (40), at Freuchie and Kingskettle; county clerk, Cupar.

Friern Barnet.—Houses and flats, Alexandra estate (£186,250); U.D.C. surveyor.

Glasgow.—560 additional houses at Pollok (£1,260 per house), 500 steel houses, 1,300 houses at Balornock and 800 houses throughout the city; housing director.

Industrial estate for light industries, Carntyne-hall Road; city architect.

Ilkeston.—Houses (250), Kirk Hallam estate; borough engineer.

Kilmarnock.—Factory for Glacier Metal Co., Ltd. (£65,000); company's architect.

Lanarkshire.—Houses (134), King's Park; architects, McTaggart & Mickel, Glasgow.

Littlehampton.—Sewage works (£100,000); J. D. & D. M. Watson, consulting engineers.

Houses (78), Thorncroft estate (£91,984); Crosby & Co., Ltd., Farnham.

Works extensions, Gloucester Lane; A.1. Die-Casting Tool Co.

Longbenton.—Houses (50), for the U.D.C.; W. Leech, builder, 2, Clayton Street, Newcastle-on-Tyne.

Manchester.—Extensions, College of Technology, Whitworth Street (£264,000); J. Dickinson & Co. (Builders), Ltd., Fairclough Street, Bolton.

Middlesbrough.—Houses (56), for Town Council; J. A. Kenyon, borough engineer.

Newcastle-on-Tyne.—Houses (1,000), Kenton; city architect, 18, Cloth Market, Newcastle.

Northampton.—Houses (48), at Duston; R.D.C. surveyor.

Porthcawl.—Houses (50), for U.D.C.; T. E. Llewellyn, surveyor, 59, Queen Street, Cardiff.

Rotherham.—Works additions; Fullerton Road; Owen & Dyson, Ltd.

St. Marylebone.—Reconstruction of wharves (£228,500); borough engineer.

Housing schemes (£644,700); Louis de Soissons, architect.

Southport.—Development, Peter Pan Pool, etc., foreshore (£20,000); Maxwell, Manners & Pring, Ltd.

Houses (84), Russell Road estate (£99,333); L. Livesey (Builders), Ltd.

South Shields.—Houses (106), and block of flats; borough engineer.

Houses and shops, Horsley Hill (£36,000); Col. John Reid, borough engineer.

Dining rooms, Barnes and Gilbert Street schools; borough engineer.

Houses (306), on various sites; W. Leech, builder, 2, Clayton Street, Newcastle-on-Tyne.

Stowmarket.—Permanent houses (66), Bury Road estate; J. Black, surveyor, Council Offices.

Stroud.—Houses (40), Bisley Old Road, for U.D.C.; F. Foster Langley, surveyor, Council Chambers, High Street.

Tutbury.—Permanent houses (52), for R.D.C.; R. S. Litherland, architect, 10, High Street, Burton-on-Trent.

Wallasey.—Houses (46), Reeds Lane; borough engineer.

Wallsend.—Library, Station Road; borough engineer.

West Riding.—Secondary school, Bawtry; county architect, Wakefield.

Whitby (Yorks.).—Houses (38), for Rural Council; surveyor, R.D.C.

Workington.—Five factories, Salterbeck; Sir Alexander Gibb & Partners.

York.—Temporary school, Ashfield estate (£4,688); F. Shepherd & Sons, Ltd.

Reports on German Industry

FURTHER reports from the British and Combined Intelligence Objectives Sub-Committees have been made available through the Stationery Office, including the following:—

"German Refrigeration Industry" (File No. XXIV-30, price 6s.) covering plants used for a variety of purposes such as public service cold stores, the manufacture of "Buna" synthetic rubber, aircraft engine testing, etc.

"Land und Seekabelwerke" (File No. XXV-33, price 1s.) describing manufacturing methods and giving formulæ of "Buna" insulating compounds employed.

"I. G. Farbenindustrie Laboratory, Leverkusen" (File No. XXV-34, price 1s.) dealing with investigations into the properties and capabilities of synthetic rubbers.

"Electro Schmelzewerke A.G., Kempten, Allgau, Bavaria" (File No. XXVI-35, price 1s.) treating of the production of oxide ceramic.

"M.W.M., Mannheim; Daimler Benz, Rothenbach; Brown Boveri Co., Mannheim" (File No. XXVI-4, price 1s.) describing the output of oil engines for various purposes including the driving of generators.

"Philips Valvo Works, Hamburg; Hammerwerke (Valve Works), Minden; C. H. Muller A G. (X-ray Tube Factory), Hamburg" (Final Report No. 65, Item No. 22, price 1s. 6d.). The Hammerwerke, Minden, is built inside a mountain and provides 95,000 sq. ft. of floor space. The report covers production at the three works and their place in the German system.